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TELEGRAPHIC ADDRESS—LANCET, WESTRAND LONDON TELEPHONE NUMBER—GERRARD 5356

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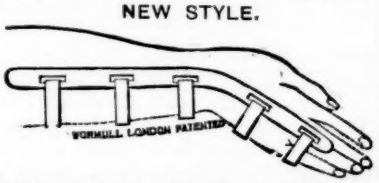

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CONTENTS.

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THE LETTSOMIAN LECTURES on War Surgery of the Abdomen. Delivered before the Medical Society of London by CUTHBERT WALLACE, B.S. Lond., F.R.C.S.Eng., C.M.G., Surgeon to St. Thomas's Hospital; Consulting Surgeon, British Expeditionary Force. —Lecture II. 597

ORIGINAL ARTICLES.

Studies in Wound Infections: On the Question of Bacterial Symbiosis in Wound Infections. By S. R. DOUGLAS, M.R.C.S., L.R.C.P. Lond., Captain, I.M.S. (retd.); First Assistant, Bacteriological Department, Medical Research Committee, National Insurance Act; A. FLEMING, M.B., B.S. Lond., F.R.C.S. Eng., Assistant, Bacteriological Department, Medical Research Committee; and L. COLEBROOK, M.B., B.S. Lond., Captain, Royal Army Medical Corps (T.); Assistant, Bacteriological Department, Medical Research Committee. (From Inoculation Department, St. Mary's Hospital.) 604

Clinical Types of Subtertian Malaria as seen in Salonika in September, October, and November, 1916. By A. W. FALCONER, M.D. Aberd., M.R.C.P. Lond., Major, Royal Army Medical Corps (T.); and A. G. ANDERSON, M.D., M.R.C.P., Temporary Captain, Royal Army Medical Corps 607

Notes on the Symptomatology of Paratyphoid Fever. By J. M. FORTESCUE-BRICKDALE, M.A., D.M. Oxon., M.R.C.P. Lond., Captain, Royal Army Medical Corps (T.F.).—(*Illustrated*) 611

An Improved Method for the Estimation of Sugar in the Urine and Blood. By P. J. CAMMIDGE, M.D. Lond. 613

MEDICAL SOCIETIES.

ROYAL SOCIETY OF MEDICINE:
SECTION OF ANÆSTHETICS:—Anæsthetics at a Casualty Clearing Station 615

ROYAL ACADEMY OF MEDICINE IN IRELAND:
SECTION OF MEDICINE:—Sudden Death in Tabes Dorsalis.—Limitations of Vaccine Treatment 615

REVIEWS AND NOTICES OF BOOKS.

Organisation Physiologique du Travail. By Jules Amar 615
Journal of Physiology. Vol. LI., Nos. 1 and 2 616
Maternity and Child Welfare. Vol. I., No. 3 617
The Child. Vol. VII., No. 6 617

REPORTS AND ANALYTICAL RECORDS FROM THE LANCET LABORATORY.

The White Wines of Anjou and Touraine (France) 617
Antiphlogistine 618

NEW INVENTIONS.

An Automatic Intermittent Wound Irrigator (Captain J. Fraser, R.A.M.C., Corporal S. D. Studd, R.A.M.C.) 618

LEADING ARTICLES.

THE CENTRALISATION OF PUBLIC HEALTH 619
BONE GRAFTING 620
PROFESSIONAL ORGANISATION AMONG MEDICAL MEN 621

ANNOTATIONS.

The Prevalence of Measles 622
Bread Economy 622
Voluntary Acceleration of the Heart-rate 622
Some Essential Differences between Animal and Vegetable Fats 623
A Case of Post-operative Tetany 623
The Inventor of Esperanto 624
Hydrocarbons in Fish Liver Oil 624

SPECIAL ARTICLES.

Tuberculosis in Australia: Factors concerned in the Control of the Disease.—Notification.—Death-rate in Relation to Age.—Distribution.—Preventive Measures 625

The Control of Venereal Diseases: The Bootle Scheme.—Antimonial Treatment of Phagedæna and Syphilis.—Post-graduate Summer Courses in London 628

Paris: The Results of Operation in Purulent Arthritis.—Diphtheria in the Army.—"Jigsaw" Autoplasty 627

The Services: Royal Naval Medical Service.—Army Medical Service.—Royal Army Medical Corps.—Deaths in the Services 629

URBAN VITAL STATISTICS:
English and Welsh Towns 627
Scotch Towns 627
Irish Towns 627

CORRESPONDENCE.

Radiation in Malignant Disease (Dr. E. Graham Little, Captain Francis Hernaman-Johnson, R.A.M.C.) 623

The Technique of Lumbar Puncture (Surgeon F. A. Williamson, R.N.) 628

Economy in Rubber Gloves (Sir W. Arbuthnot Lane, Bt., C.B., Major Henry Blakesley, R.A.M.C. (T.)) 634

Prolonged Nasal Feeding (Dr. E. E. Moore) 635

THE WAR.

The Casualty List 629
The Honours List 629
Deaths among the Sons of Medical Men 630
Medical Mobilisation in America 630
The War and Hospital Ships 630

MEDICAL NEWS.

Bristol Royal Infirmary 603
Shortage of Midwives in Cornwall 610
The late Mr. Alfred Upton 610
Death of Mr. John King 614
Royal College of Surgeons of England 624
The late Charles Moon, M.D. Edin. 626
Blinded Sailors and Soldiers in Edinburgh 627
Examining Board in England by the Royal Colleges of Physicians of London and Surgeons of England: Pass-list 631
University of London: Pass-list 631
Society of Apothecaries of London: Pass-list 631
Royal Colleges of Physicians and Surgeons of Edinburgh and Royal Faculty of Physicians and Surgeons of Glasgow: Pass-list 632
University of Glasgow: Pass-list 632
University of Dublin, Trinity College, School of Physic: Pass-list 632
Literary Intelligence 632
Royal Society of Arts 632
Payment for the Domiciliary Treatment of Tuberculosis in Belfast 632
Doctors of Military Age: the Squabble at Letterkenny 633

Appointments 633
Vacancies 633
Births, Marriages, and Deaths 633
Notes, Short Comments, and Answers to Correspondents 634
Medical Diary 635
Meteorological Readings 635
Editorial Notices 636
Manager's Notices 636
Acknowledgment of Communications received 638

FOR INDEX TO ADVERTISEMENTS SEE PAGE 2.

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INDEX

MEDICAL AND OTHER BOOKS AND PUBLICATIONS

PAGE

BAILLIERE, TINDALL & COX:—
Gardner—Manual of Surgical Anæsthesia ..... Cover 1

BALE, SONS & DANIELSSON:—
Maternity and Child Welfare 1
Worth—Squint ..... Cover 1

CAMBRIDGE UNIVERSITY PRESS:
Malloch—Finch and Baines: A Seventeenth Century Friendship ..... Cover 1

CASSELL & CO.:—
Jones—Military Orthopædics 6

CHURCHILL, J. & A.:—
Beatty—The Method of Enzyme Action 3
Bowlby, Sir A. A., and Andrewes—Surgical Pathology and Morbid Anatomy 3
Craig—Psychological Medicine .. 3
Crofton—Pulmonary Tuberculosis 3
Ghon—Primary Lung Focus of Tuberculosis in Children 3
Goodhart & Still's Diseases of Children 3

PAGE

CHURCHILL—(Continued).
Haig—Uric Acid in the Clinic 3
" Uric Acid as a Factor in the Causation of Disease 3
Haig—Uric Acid: an Epitome on the Subject 3
Hare—Alcoholism ..... Cover 1
Hartridge—Ophthalmoscope 3
" Refraction of the Eye. 3
Lucas—The Book of Prescriptions 3
Lucas & Stevens' Book of Pharmacopœias and Unofficial Formularies 3
Rowlands and Turner—Operations of Surgery ..... Cover 1
St. Thomas's Hospital Reports .. 3
Smith—The Cure of Obesity and Obese Heart 3
Smith—Taylor's Medical Jurisprudence 3
Squire's Companion to the British Pharmacopœia ..... Cover 1
Transactions of the Ophthalmological Society of the United Kingdom 3
White—Materia Medica 3

PAGE

DANIEL:—
Rabagliati—Initis or Nutrition and Exercises..... 6

HILTON & CO.:—
Ghosh's Materia Medica 6

LEWIS & CO:—
Elliot—Glaucoma ..... Cover 1
Moullin—Enlargement of Prostate ..... Cover 1
Moullin—The Biology of Tumours Cover 1

MACMILLAN & CO.:—
Allbutt, Sir Clifford—Diseases of the Arteries, including Angina Pectoris 4
New System of Gynecology 4
New System of Medicine 4

MEDICAL PUBLISHING CO.:—
Lane, Sir A.—Operative Treatment of Fractures 4

NISBET & CO.:—
Romer and Creasy—Bonesetting, &c. ..... Cover 1

PAGE

SAUNDERS COMPANY:—
Allen—Local Anæsthesia 5
Anders—Practice of Medicine 5
Crile & Lower—Anoci-association. 5
DaCosta—Physical Diagnosis 5
De Schweinitz—Diseases of the Eye 5
Kerley—Practice of Pediatrics .. 5
Kyle—Nose and Throat 5
Moorhead — Traumatic Surgery Cover 1

WRIGHT & SONS (BRISTOL):—
Index of Differential Diagnosis of Main Symptoms ..... Cover 1

MEDICAL LIBRARIES, &c.:—
Baker—Books 6
Behnke—Stammering, Lisping, & Cleft-Palate Speech 6
Dartmouth-road.—Cunningham's Practical Anatomy wanted..... 51
Ketley—Stammering 6
Matthews—Wood: Application of Trusses to Hernia 6

OFFICIAL AND GENERAL ANNOUNCEMENTS

ASSISTANCIES, MEDICAL .. 50, 51

ASYLUMS, HOMES, &c.:—
Ashwood House, Kingswinford .. 44
Barnwood House Hospital 45
Bishopstone House, Bedford..... 44
Brunton House, Lancaster..... 44
Camberwell House, Peckham-road 48
Clarence Lodge, Clapham Park .. 44
Colthurst House School, Alderley Edge 44
Co-operative Sanatorium, Billericay 48
Coppice, The, Nottingham..... 45
Court Hall, Kenton, near Exet'r. 48
Dartmoor Sanatorium 47
Dalrymple House, Rickmansworth 47
David Lewis Colony, Alderley Edge 44
Duff House, Banff 47
General Manager, Craven street.. 48
Ghyllwoods Sanatorium 48
Grove House, Church Stretton .. 45
Grove, The, Catton, Norwich 45
Haslemere Nursing Home 48
Haydock Lodge, Newton-le-Willows 48
Heigham Hall, Norwich 45
Homes for Inebriate Women 48
Hove, Sussex 48
Littleton Hall, Brentwood 48
London Fever Hospital..... 45
Maling Place, Kent 45
Melbourne House, Leicester 48
Mendip Hills Sanatorium 48

ASYLUMS—(Continued).
Moat House, Tamworth 45
Newmains Retreat, Lanarkshire.. 48
Nordrach-on-Dee, Banchory 47
Northumberland House, Finsbury Park 44
Northwoods House, Winterbourne 48
Peckham House 46
Pendyffryn Hall Sanatorium, Nordrach-in-Wales 47
Plympton House, Plympton 45
Portsmouth Corporation Mental Hospital 44
St. Andrew's Hospital, Northampton 45
Shaftesbury House, Formby-by-the-Sea 43
Springfield House Private Asylum, Bedford 45
Stretton House, Church Stretton. 45
The Grange, near Rotherham 45
Vale of Clwyd Sanatorium 47
Warneford Asylum, Oxford 44
Westholme, Torquay 48
Wye House, Buxton 45

FINANCIAL, &c.:—
Equitable Reversionary Interest Society 42

HEALTH RESORTS, BATHS, &c :—
Caterham Sanitarium 48
Droitwich Brine Baths..... 48
Smedley's, Matlock..... 48

HOSPITAL, INFIRMARY, SANATORIUM, &c., VACANCIES.. 48 50

HOUSE & ESTATE AGENTS:—
Bailey, Hart street, Bloomsbury.. 51
West, Clapham Junction..... 51

LIFE & FIRE ASSURANCES, &c.:—
Prudential 42

MASSAGE:—
Associated Male Nurses and Masseurs 43
Cutter 43

MEDICAL ACCOUNTANTS, &c.:—
Turner..... 51

MEDICAL AGENTS:—
Fieldhall, Limited 52
Manchester Clerical, &c., Assoc.. 52
Medical Agency..... 52
Needes, J. C. 52
Peacock & Hadley 52
Turner 52

MEDICAL SCHOOLS:—
(LONDON.)
London School of Clinical Medicine 42
St. Mary's Hospital Medical School..... 42
West London Post Graduate College 42

NURSES' ASSOCIATIONS:—
Co-operation of Temperance Male and Female Nurses 43
Female Nurses Association 43
General Nursing Association 44

NURSES' ASSOC. (Continued).
Hospital for Sick Children..... 43
London Nurses' Association 43
London Temperance Nurses Co-operation 44
Mental Nurses Association 43
Mental Nurses' Co-operation..... 43
New Mental Nurses' Co-operation 43
Nurses' Association 44
Nurses' Co-operation..... 44
Registered Nurses' Society 44
St. John's House 43
St. Luke's Hospital 44
Temperance Association of Male Nurses, Ltd..... 43
The Retreat, York 43

OFFICIAL NOTICES:—
City of London Lying-in Hospital 42
Guy's Hospital 42
Incorporated Society of Trained Masseuses 42
London School of Tropical Medicine 42
Queen Charlotte's Lying-in Hospital 42
York-road General Lying in Hospital 42

PARTNERSHIPS & PRACTICES. 51

RAILWAY & STEAMSHIP CO.'S.:—
Royal Mail Steam Packet Co. 42

TUTORS & LECTURERS:—
Schnelle—Stammering 6
Weymouth 42

TRADE AND MISCELLANEOUS ADVERTISEMENTS

AMBULANCES:—
St. John Ambulance—Invalid Carriages..... 7

BOTTLE MERCHANTS:—
Isaacs 41

CARRIAGES, MOTORS, &c.:—
Armstrong—Liveries 7
Beldam Tyre Co.—Beldam Tyres.. 7
Hertford street, Mayfair—Ohio Electric Coupé 51
Offord & Sons—Ford Cars 7

CHEMISTS & DRUGGISTS:—
Abbey Chemical Company—Beta Eucaine B.P. 39
Allen & Hanburys—Bynu Cascada 20
Bynogen 19
Allenburys Castor Oil 38
Angier Chemical Co—Angier's Emulsion 12
Anglo-French Drug Co.—Cuprase, Iodargol, Iodeol 27
Peroxidine, Hemoplase 28
Bathley & Watts—Bathley's Liquors ..... Cover iii
Boots Pure Drug Co.—Aspirin Compressed Tablets, &c..... 10
British Organotherapy Co., Ltd.—Lymph Compounds..... 9
British Oxygen Co.—Oxygen..... 35
Burroughs Wellcome & Co.—Kepler Malt Products 25
Tabloid Brand Magnesium Sulphate Compound, &c.. Cover iv
Christy & Co.—Ergcapiol..... 36
Clay, Paget & Co.—Glycolactophos 35
Cook & Co.—Cofectant Lozenges..... Cover ii
Duncan, Flockhart & Co.—Tuberculins, Vaccines 22
Evans Sons Lescher & Webb—Capsul. Ol. Santal. Flav..... 13
Bacterial Vaccines for Therapeutic Purposes 13
Fletcher, Fletcher & Co.—Vibrona 17

CHEMISTS—(Continued).
Gale & Co.—Elixir Cresolis c. Heroin Co., &c..... 38
Haller—Maltose, Galactose, &c... 38
Heppells—Urodoral, Jubol, Globeol, &c. .. 14
Hewlett & Son—Liq. Santal Flav. c. Buchu et Cubeba 38
Hogg & Son—Protein Nerve Food 6
Hudson's Eumenthol Chemical Co.—Eumenthol Tooth Powder. 37
Humphrey Taylor & Co.—Junora. 34
May & Baker—Arsenobillon and Novarsenobillon 9
Moore & Co., Ltd.—Lymm-Pure-Salt 40
Parke, Davis & Co—Mixed Infection Phylacogen.... 15
Price's Patent Candle Co., Ltd.—Price's Night Lights..... 37
Raines & Co.—Slinger's Nutrient Suppositories 40
Richards & Sons—Lactopeptine 40
Squire & Sons—Glyphocal, Ferocal, &c..... 24
Tidman's Sea Salt 38
Vinolia Co.—Vinolia Medicated Skin Soap .. 18
Wilcox, Jozeau & Co.—Arhéol 39
Nativelle's Crystallised Digitaline 36

DISINFECTANTS:—
Condy's Fluid..... 7
Evans Sons Lescher & Webb—Lysol Evans..... 13
Quibell Bros.—Kerol 39

FOODS:—
Allen & Hanburys—Allenburys Foods 21
Aylesbury Dairy Co.—Humanized Milk 38
Benger's Food 11
Blatchley's Dietetic Preparations 38

FOODS—(Continued).
Carnrick & Co.—Dry Peptonoids. 23
Freemans Devonshire Custard.... 6
Glaxo 16
Hommel's Hæmatogen.... Cover iii
Savory & Moore—Peptonised Milk Preparations.. 34
Southall Bros. & Barclay—Vitafer 38
Valentine's Meat-Juice..... 52
Van Houten's Cocoa 35

FURNITURE, &c.:—
Carters—Furniture for Invalids and Hospital Supplies 8

HOSPITALS (ISOLATION):—
Humphreys, Limited—Mobile Hospital Buildings ... 29
Sailors' and Soldiers' Mobile Panel Huts and Hospital Wards..... 29

MED. & SURG. APPLIANCES:—
Bailey & Son—Hospital Furniture..... 31
Operation Theatre Outfit 31
Davis—Lukens Sterile Catgut with Dulox Needle..... 7
Davis & Geck—Sutures fit for Surgery 7
Down Bros.—Differential Stethoscopes 32
Hoefticke—Extension Appliances 28
Leslies, Ltd.—Leslies' Zopla ..... Cover ii
Macfarlan & Co.—Surgical Catgut..... 41
Millikin & Lawley—Osteology, &c. 31
Robinson & Sons—Gamgee Tissue 6
Seabury & Johnson—Mead's Rubber Adhesive Plaster 30
Timpson & Co.—Reliable Ligatures 41
Wolfe & Hollander—Wolfhol Restful Chair 31
Wormull—System of Aluminium Splinting ..... Cover ii

OPTICIANS:—
Watson & Sons, Ltd.—Microscopes..... 41

STATIONERY, &c.:—
Anderson & Son—Doctors' A/c Forms, &c. 51

STOVES, &c.:—
British Commercial Gas Association—Gas Boilers 33

TAILORS, BOOTMAKERS, &c.:—
Dowie & Marshall—Hygienic Bootmakers 41
Evans & Co.—Service Uniforms, &c. 6
Harry Hall—Service Dress R.A.M.C. and Navy..... 7

TYPEWRITING, &c.:—
Taylor's Typewriters..... 7

VACCINE LYMPH:—
Chaumier's Calf Lymph 40
Jenner Institute for Calf Lymph..... 40
Renner's Calf Lymph Establishment 40

WINES, BEER, SPIRITS, &c.:—
Humphrey Taylor & Co.—"G. B." Diabetes Whisky 34

X-RAY, &c., APPARATUS:—
Medical Supply Association—Kompact X-Ray Installation .. 32
Siemens Brothers & Co.—Foot Switch for X-Ray Outfits.. 8

MISCELLANEOUS:—
H. R., Twickenham—Röntgen Ray Apparatus, &c. .. 51
Senior Medical Officer, Dagenham Sanatorium—Revision Lessons in Bacteriology required 51

The Lettsomian Lectures
ON
WAR SURGERY OF THE ABDOMEN.

Delivered before the Medical Society of London

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LECTURE II.[1]

Delivered on March 22nd, 1917.

THE POSSIBILITY OF SPONTANEOUS RECOVERY AFTER THE PERFORATION OF HOLLOW VISCERA.

MR. PRESIDENT AND GENTLEMEN,—It is quite true that people do recover after wounds of the hollow viscera, but the number is very few. Those who recover may be said to be the exceptions that prove the rule.

1. We have instances of late-formed fæcal fistula which may be due to sloughing of the bowel wall or to actual perforation. There have been fairly frequent instances of recovery after wounds of the colon, as has been insisted on by Makins, who, by the way, attributes such a favourable result to the intense local reaction produced by the contents of the colon.

2. Actual proof of the healing of the stomach was seen in a case in which a fragment of a mantle of a bullet perforated the liver on the anterior surface, penetrated its thickness, and wounded the stomach. The officer lived some days, and at the post-mortem one found evidence of a wound of the stomach which was closed, partly by its own reaction and partly by the application of the left lobe of the liver. The post-mortem was made by Captain J. S. Dunn. I have no doubt that if this officer had not succumbed to his other injuries the wound of the stomach would at the worst have led to a localised abscess.

3. For the history of this remarkable case I am indebted to Surgeon-General Bowlby and Captain Bell.

A soldier was shot from side to side through the body at the battle of Loos. He was not operated on and recovered. As far as I know, there was nothing special about his convalescence. He was again shot in the abdomen in the battle of the Somme and was operated upon. When the abdomen was opened several perforations of the small intestines were found in the neighbourhood of a mass of adhesions. The wounded and adherent segments were excised and the man made a good recovery. On slitting up the adherent coils an entero-enterostomy was found between two adjacent loops; in addition there were several small herniated diverticula of the mucous membrane obviously pointing to closure of the previous penetrations.

This case is of interest because the process of healing corresponds to that which Captain H. Drummond has shown to be the case when the intestines of rabbits are perforated and put back without suture. The herniated mucous membrane remains herniated and gradually becomes covered with a layer of lymph which slowly organises and seals the hole; the herniated mucous membrane still forms a diverticulum.

RUPTURE OF VISCERA WITHOUT PENETRATION OF THE ABDOMINAL CAVITY.

1. As in civil life, one meets with a fair number of abdominal injuries caused by horse kicks; by falling in of dug-outs; by burial of men by shell explosions and by blows of fragments of wood which are hurled about; they present nothing out of the common and the injuries seen are the same as in civil life. Captain J. B. Haycraft had one case which may be mentioned, in which the post-mortem examination on a man who died after burial by shell explosion showed numerous contusions of the small intestine without rupture.

2. Similar injuries are caused by large shell fragments, usually shell caps, and several cases of the latter injury have been seen in which rupture of the intestine was accompanied by extensive contusions. Some years ago Makins wrote a paper on this subject, and he came to the conclusion that such injuries are caused by the bowel being caught between the unyielding posterior abdominal wall and the on-coming object. This supposition, I think, is strengthened by the association of bruises along with perforations in the case already quoted.

3. *Rupture of solid organs by indirect violence of a passing projectile.*—Such injuries are by no means uncommon. Here is a picture of a kidney in which many cracks in the capsule were produced by shell fragments which did not themselves touch the organ. I have also seen two cases of ruptured spleen; in each case the left lower chest was hit and the ribs broken in both cases. In one the diaphragm was intact, but on opening the peritoneum much blood escaped and there was an extensive tear in the spleen. In another case the diaphragm was ruptured over a small area, the blow being a glancing one. There was a corresponding wound on the outer surface of the spleen, and from this wound there ran in all directions radiating fissures in the capsule, showing that the spleen had been burst by the indirect blow it had received.

4. *Cases in which the viscera are damaged by indriven bone fragments.*—(*a*) There are many cases of injury to the liver and spleen by the driving in of fractured ribs. There is nothing particular in these.

(*b*) The cæcum and the ascending and descending colon and also the small gut in the pelvis are all apt to be injured by small bony spicules driven in through the peritoneum. Although the projectile itself does not penetrate this membrane, it is important to remember this possibility, because when such wounds are explored it is most probable that the small holes caused by the bony fragments would be overlooked and the peritoneum assumed inviolate.

5. *Rupture of hollow organs by indirect violence.*—There seem to be two classes: (*a*) Rupture of the intestine by a bullet without penetration; and (*b*) rupture of a viscus out of the track of a perforating bullet. Cases have been reported by Owen Richards, John Fraser, J. W. Dew, and others.

(*a*) The first case was that of a man whose recti were divided almost completely by bullet. The wound was explored and the posterior rectus sheath found intact. As there were no symptoms the abdomen was not opened; the man died. At the post-mortem examination a careful search failed to show any rupture of the peritoneum. There were three holes in the small intestine which lay immediately under the wound in the abdominal wall showing the gut had not moved, although more than 24 hours had elapsed since the receipt of the injury.

Fraser's case was that of a man wounded by a piece of shell in the right iliac fossa and in which the cæcum was found bruised and a small hole in the mesenteric border of the ileum.

In Dew's case the projectile had cut all the abdominal wall through save the peritoneum, through which the cæcum could be seen. As there were no symptoms the abdomen was not opened but the man died from a ruptured ileum.

(*b*) Fraser has also published another case in which the bullet penetrated the abdomen just below the umbilicus. There were no symptoms at first, but when they arose later on, cœliotomy showed a ruptured bladder. The bladder was apparently out of the direct line of the projectile.

These ruptures may be caused apparently in three possible ways. For instance, (1) when an object such as the abdomen and its contents, made up of layers of varying toughness, is sharply hit, more friable layers underneath may come away, while the more resisting overlying layers remained intact. (2) This may be termed the "paper-bag" theory, the intestine being ruptured by a smart blow in a similar way to that in which an inflated paper bag is burst on being hit. I do not know that there is any proof that this happens, but it is rather a seductive theory. (3) There is another possibility which must not be lost sight of. A man when he is hit may fall to the ground or against some object and the ruptured intestine be due to the blow thus produced and not to the actual missile which was the indirect cause of the fall.

MECHANISM OF WOUND PRODUCTION AFTER PENETRATION.

The multiplicity of wounds of the small intestine has raised some doubt as to their method of production, especially in the case of bullets, where types of wound widely different in nature are seen. The question arises, Can a bullet pursuing a straight course cause these injuries, or must we invoke a rotation of the bullet or a bursting effect?

If a bullet is rotating quickly on a transverse axis it could easily produce complete division of the gut, but if it is radiating quickly enough to produce such injuries

[1] Lecture I. was published in THE LANCET of April 14th, 1917.

it is hard to see how it could at the same time produce small perforations. Some support is given to the rotation theory by the retention of many bullets, as one knows that their flight is unstable at the end. If the rotation theory is correct, one ought to have some evidence of this rotation at the entrance and exit holes. As a matter of fact, it is impossible to establish any relations between the size of the entrance and exit wounds in the skin and the amount of damage done to the intestine. As to the possibility of a bursting effect, it is impossible, I think, to make any definite statement on the subject. All that one can say is that when great vessels are hit by bullets nothing has ever been seen in the nature of a lesion which suggested the presence of the so-called hydrostatic phenomena.

I am rather inclined to think myself that these different types of wound are caused by the varying state of distension of the small gut. As is well known, one meets with lengths of the small intestine alternately distended with air and collapsed. If the bullet strikes a distended portion it will perforate it or cut a hole in it. If it strikes a portion which is collapsed, the intestine is so small that the diameter of the bullet is such that it could divide both coats.

DIAGNOSIS OF INTRAPERITONEAL DAMAGE.

This is determined in three ways: (*a*) By inspection; (*b*) by experience; (*c*) by symptoms. With all possible care and an extensive experience and a full appreciation of the numerous fallacies, it is frequently difficult to make sure that the wound is penetrating. If it is difficult when there is an entrance and exit wound it is still more so when there is only one wound. It may be that shock, hæmorrhage, rigidity, or rapid pulse will be present, but in some cases which are received early there will be no such guides. The wound of a hollow viscus may in itself have no symptoms if it is not extensive enough to produce shock; it is usually hæmorrhage or peritonitis which gives the danger-signal. As there is a distinct relation between the interval since the receipt of the wound and the operation it is important to be able to determine the probability of penetration.

(*a*) *By Inspection.*

Antero-posterior wounds are the easiest to judge. The only point to be remembered is the thickness of the flank muscles. Below the transpyloric plane a wound with the entrance on one side of the middle line and an exit exterior to the lateral body line of the same side is very often non-penetrating, or one that has just opened the peritoneum. Above the transpyloric line such a wound, owing to the rounded form of the thorax, is almost certain to be penetrating. The bullet which passes in and out between the semilunar lines probably does not open the abdomen, while that wound that passes in and out outside these lines probably does. In the longitudinal direction a bullet which enters near the costal margin and emerges above the groin will most likely traverse the abdomen. Where it is a question of single wounds there is really nothing except the symptoms to guide one, as it is usually impossible to tell the direction of the projectile. A great deal of help is afforded by an X ray apparatus in such cases.

One case may be quoted as showing the difficulty of judging where a missile has gone.

A man was shot beside the umbilicus. The shape of the wound suggested a bullet; the area was a dangerous one, so it was determined to explore the abdomen. As the wound was in a convenient situation the exploratory incision was made through it. It was then found that the rectus muscle was torn the length of the incision. This was enlarged downwards to the pubes, the muscle being much torn down to the bone, but the sheath and peritoneum were intact. The bullet had passed down behind the pubes and, as there were no symptoms, nothing further was done, and the case, after an interval of several days, was sent to the base doing well.

(*b*) *By Experience.*

This has shown that one has to be very careful in making a negative diagnosis, and it has also shown the wisdom of operation in doubtful cases. Bomb wounds require some notice under this heading. The fragments into which a bomb is broken on explosion are often very small, but so high is their velocity that they have very great power of penetration. The wounds are often so small and insignificant that it sometimes takes some strength of mind to explore the abdomen, although the symptoms point to the possibility of visceral involvement. The number of these wounds makes individual exploration impossible, and the only way of settling the matter is to explore the abdomen by a well-placed incision, irrespective of the situation of the wounds.

(*c*) *By Symptoms.*

These may be enumerated as follows:—Appearance, pulse, vomiting, hæmorrhage, rigidity, pain, tenderness, shock, and subjective sensations.

Appearance.—Usually a man hit in the abdomen looks ill. He is shocked and cold, often in spite of blankets and hot bottles, with which he has been surrounded in the ambulance. Sometimes he is apathetic and quiet; sometimes restless—sometimes from pain—sometimes from distress. He may be blanched or of a fair colour, even normal in appearance. Before rapid evacuation was the rule I was struck by the fallaciously good facial expression of some of these cases, and it was often that one experienced a shock on taking up such a man's hand to find it cold and clammy and the pulse running or even not palpable. Such cases invariably die, and operation only hastens their end.

Pulse.—A rapid pulse, a pulse that does not fall, or a rising pulse is an indication for operation. A slow pulse is not necessarily a contra-indication unless the wound is in a non-dangerous area such as the liver. I have seen a man with a pulse of 60, with four holes in his small intestines, four hours after receipt of the injury. A rapid pulse is caused by loss of blood, and later on by peritonitis and sepsis. It does not seem to have any very definite connexion with the number of lesions of the intestine. The pulse often falls with rest and infusion, and it often happens that a falling pulse is more an indication of the possibility of operation than a contra-indication to operative measures. A rising pulse is an indication for operation.

From Table V. one can see the general average of the pulse of a man wounded in the abdomen. A pulse of 100 is very frequent and, on the whole, gives a good prognosis. A pulse of 110 seems to be a critical one, for the mortality after this rapidly mounts.

TABLE IV.

Pulse up to—	-60		-70		-80		-90		-100		-110		-120		-130		-140	
	B.	D.	B.	D.	B.	D.	B.	D.	B.	D.	B.	D.	B.	D	B.	D.	B.	D.
	1	1	3	0	8	6	14	10	49	23	12	18	21	48	5	23	7	36

B = To base. D = Died.

Mention may be made here of unexpected results which some pulse-rates show. A man with a pulse of 160 with a wound in the liver went to the base without operation. Another pulseless man recovered after his bladder and small intestine had been sutured. A man with a pulse of 60 died from the effects of hæmorrhage, although the bleeding was stopped by operation. A fourth man with a pulse of 90 died from gas gangrene in the abdominal wall; a fifth with a pulse of 80 died from peritonitis on the third day; and another with a pulse of 160 recovered, the reason of the rapidity being extraperitoneal hæmatoma of the bladder, which was drained. From these instances it can be seen that, although the pulse is a very good indication, there are many surprises for the surgeon.

Vomiting.—Wounds of the stomach nearly always lead to vomiting and very often to hæmatemesis, but vomiting is also met with in all kinds of abdominal injury; and beyond the fact that its absence shows that the stomach is most probably not involved, it has no special significance.

Hæmorrhage.—This will be dealt with under wounds of different organs, and it is sufficient to say here that with the exception of blanching and a rapid pulse, both of which may be produced by other causes, the classical signs, such as restlessness, blindness, or air hunger, are usually absent. When present it gives the ordinary physical signs, but, as is well known, these are not very helpful, as to produce them the amount of blood may have to be very great.

Rigidity.—A very constant but varying symptom when the cases arrive. It is seen in low thoracic injuries, wounds of the abdominal wall, and in contusions of the abdomen and with true visceral injuries.

(*a*) The rigidity produced in the abdomen by low thoracic injuries is well known, and it renders diagnosis very difficult,

especially in those cases where from a study of the track the bullet may or may not have entered the abdomen.

One such case I well remember in which a man, hit in the lower right axillary region, presented a universal rigidity of the abdominal wall accompanied by considerable pain. His condition otherwise was not bad. It was determined to watch him, and he was put to bed and kept quiet for three hours. At the end of that time the rigidity had become board-like. There was considerable increase in his pain and his pulse-rate was slightly accelerated. An abdominal exploration showed that after all the abdomen was uninvolved, and that the only possible injury was a wound of the liver on its extraperitoneal surface. Curiously enough this man died a week later from tetanus.

I do not know that there is any royal road to diagnosis between a thoracic and abdominal wound; every case must be judged on its merits. Captain B. C. Maybury has an idea that superficial abdominal tenderness is rather a feature of thoracic wounds.

(*b*) In the case of abdominal wall wounds the rigidity is apt to be local, and, as a rule, it does not give rise to very much confusion. Contusions of the abdomen do present considerable difficulty, and in cases which have recovered without operation I have seen rigidity, an extremely rapid pulse, and pallor all combined. Wounds of the pelvic floor, even when not penetrating, will produce a reflex hardness of the anterior wall, and the same may be said for some wounds of the upper thigh.

(*c*) *Visceral injury.*—Injuries both of the solid and hollow viscera are accompanied by rigidity. This rigidity seems to be brought about in three ways: (1) it is a reflex protective measure after the receipt of any wound; (2) it is also brought about by irritation of the peritoneum either by blood or infection; (3) it is largely independent of the amount of peritoneal infection, and occurs in extreme form without any naked-eye appearances of inflammation. Under such conditions it is generally accompanied by very great pain.

Rigidity often occurs when there is blood in the abdomen the source of which is only a wound of the mesentery or omentum. It is not as a rule very marked in these cases, and tends to subside with time in distinction to that due to peritonitis, which is progressive. One occasionally sees a somewhat rigid and tumid condition of the abdomen in cases arriving late. Such a condition is, according to my experience, usually only a sign of hæmorrhage which has been arrested, and I always advise the leaving alone of such cases.

Considered clinically, (1) rigidity may be slight, and this generally or local. (2) It may be confined to one part, and if this spreads it generally means an intestinal lesion. (3) Alternating rigidity. During examination the abdomen is sometimes soft and sometimes hard. This is a very puzzling condition and its indication is not very clear; it is sometimes accompanied by extensive injuries. (4) Apprehensive rigidity, if one may use the term. Here, although the abdomen looks soft and moves on respiration, it at once hardens when the hand approaches to palpate. As a rule, it is accompanied by no serious injury. (5) Board-like rigidity is most puzzling when accompanied by a slow pulse. If there is extreme pain it nearly always means that there is a wound of the intestine. (6) Complete absence of rigidity; this, when accompanied with obvious penetration of the abdomen, has often a grave significance, as has been pointed out by Taylor and Meyer. Such cases often quickly end fatally. It may be here stated that morphia in moderate doses seems to have very little effect on the state of the abdominal wall.

The spinal abdomen.—One has to be on one's guard not to be misled by the slightly rigid and tumid abdomen which is met with in cases of spinal injury, and especially when such injuries are accompanied by vomiting. This state of the abdomen is sometimes caused by a distended bladder, but it may be present without it.

Tenderness.—This phenomenon has very much the same value as the tenderness met with in penetration of the intestine due to disease. *Pain* is nearly always present in some form or another, but it varies from almost uncontrollable agony to nothing more than discomfort. There does not seem to be any particular relation between the amount of pain and the amount of injury.

Shock.

This can be considered under two heads: (1) subjective sensations; (2) shock proper.

1. *Subjective sensations.*—The sensations of a man shot in the abdomen vary in a remarkable degree. As can be well imagined the size of the projectile must have a considerable influence. The shell fuse-cap produces much the same effect as a violent blow from the heels of a horse, although there may be no open wound, and the subsequent course proves that there is no visceral injury. A somewhat similar effect may be produced when a portion of the abdominal wall is torn away, but as the blow is a more or less glancing one in such conditions the amount of "knock-out" effect is often surprisingly little. Men have walked considerable distances with such wounds, their intestines supported by a bandage. To quote a case:—

A man had his abdominal wall ripped open by a bullet just as we were being compelled to evacuate a trench. He was bandaged up with a shell dressing, and insisted on walking to a trench in the rear, where he lay on the fire-step for some time until things became quiet and he was able to be taken away to the ambulance. He made a complete recovery.

Sometimes a man, though he knows that he has been hit in the abdomen, is quite unconscious that his intestine is prolapsed, although a considerable amount may be outside his body. To quote a case:—

A man was hit just above the pubes; he experienced very little inconvenience. When the first dressing was applied some of the small gut lay on the belly wall. This was covered up with a dressing and the man taken straight to an advanced abdominal hospital. When he arrived there he was in good condition and in no pain. Six or seven feet of small intestine perforated in places lay under the dressing. He made a complete recovery after operation.

When the missile is a small one and penetrates and wounds the intestine there may be very little pain or disturbance.

One man, hit in the iliac region, in whom a subsequent operation proved intestinal injury, was quite unconscious that he had received a severe wound. He thought that he had been hit in the leg, the bullet having disturbed some of the lumbar nerves.

Another man, a bearer in the R.A.M.C., who had been wounded in the abdomen and, as subsequent operation proved, in the intestine, was brought on a stretcher to an advanced dressing station, but seeing there were many wounded to be attended to he got up off his stretcher and lent a hand.

Another case may be quoted as showing how little disturbance a wound in the intestine may produce. It was one of the cases I saw early in the war, and which confirmed my opinion that the expectant treatment was wrong. This officer had a side-to-side penetrating wound of the abdomen. When I saw him at a clearing station about six hours after receipt of the wound he was in good condition, free from pain, cheerful, and smoking a cigarette. He was unoperated; he was dead of peritonitis in 24 hours. Post mortem he had a single hole in his intestine.

On the other hand, a man shot in the abdomen by a bullet or some of the smaller projectiles may experience a tremendous blow which may knock him out. Now this sensation of a tremendous blow is experienced even when small missiles hit the limbs. It is curious to remember that the blow, or kick, sensation is experienced by those who rupture muscle fibres while playing games. It is therefore legitimate to imagine that the sensations of a violent blow have nothing to do with an injury to the solar plexus.

Pain of an intense character is sometimes experienced immediately after the receipt of the wound, and it accompanies wounds both of the upper and lower abdomen. In the latter case it was specially connected with penetrating buttock wounds. The suddenness of the pain in these cases recalls that seen in perforation of gastric ulcer or appendix. This similarity suggests that the cause of pain is connected with an irritation of the peritoneum by the bowel contents, although the escape of such matter may not be perceptible at the operation. Some people hold that the contents of the jejunum are more likely to cause pain than those of the ileum.

The following case is an example of intense sudden pain and a board-like rigidity which so often accompanies it. It should be noticed that his pulse was only 60.

L. C. was wounded in the back by rifle grenade; he was admitted within four hours of the wound. He was pale and suffering intense pain in spite of morphia. His abdomen was like a board. His distress might have been increased by the fact that, being hit in the abdomen, he was quite sure

he had got to die. He was taken to the theatre and when examined the only wound found was a small puncture on the outer side of the erector spinæ. Operation disclosed one abrasion and three perforations of the jejunum. There was no visible escape of contents. Recovery was uninterrupted. The fragment that caused the injury was no larger than a large safety-match head in bulk and so small that its weight could scarcely be appreciated by the hand.

2. *Shock proper.*—Everyone understands in a general way what is meant by shock and has in his mind a picture of a patient in such a state. When asked to define what he really means by shock he will very likely be unable to answer this question. As regards the abdomen, a state of clinical shock is produced in various ways—by a violent blow; by multiple intraperitoneal abdominal injuries; by hæmorrhage; by sepsis, which seems to be of the nature of poison shock; and by pain.

If a man is hit by a large projectile the blow will produce shock, just as any other blow will do. The man is winded or knocked out. Again, extensive injuries of the abdominal wall with exposure of the intestines will cause shock. This is also true of multiple injuries of the abdominal viscera, and there can be no doubt that the gravity of any case does rapidly mount with the number of lesions in the viscera and the number of viscera injured. Apart from these generalisations, it is very hard to make any definite statement as to the relation between the amount of shock present on the one hand and the organs injured and the amount of individual damage on the other.

Some idea of what a man's state may be after a wound in the abdomen has been given when speaking of a man's subjective sensations, and it can be seen from that that immediately after the receipt of the wound that proves fatal a man may for a considerable time be able to pursue what he was doing. I might quote here another case as illustrating this.

A flying man, well over the German lines, was hit with a high-explosive shell; it entered somewhere behind the anterior superior spine, traversed the abdomen, caused two holes in the small intestine, and then lodged in the areolar tissue behind the pubes. The man brought his machine back, made a good landing, and was brought into the casualty clearing station near by in really first-class condition. He was operated on, the wounds in the intestines sewn up, and he died within 48 hours of acute sepsis produced from the retroperitoneal tissue.

There is considerable difficulty in ascertaining the connexion between the actual damage done and the amount of shock. Regimental medical officers who see cases early can form no idea, apart from the loss of abdominal wall or protrusion of viscera, what the extent of the abdominal injury is, and by the time the cases come to operation there are the added factors of loss of blood and sepsis. The amount of shock seems to be largely due to the loss of blood, and if one could only find some easy method of supplying this fluid it is possible that our results might be very greatly improved. The transfusion of blood, although it is a comparatively simple process, is more or less cumbrous and can only be employed when conditions are quiet and when a donor is available.

A word may here be said about the effect of lesions on individual organs. It has been stated before that in the case of the liver one meets with some cases of shock which do not seem to be explained by the amount of damage or the amount of blood lost. Wounds of the spleen, apart from hæmorrhage, even though severe, do not cause much collapse. The same can be said of the kidney, and this is perhaps rather remarkable when one remembers the effect of the kidney punch in boxing. In some instances there is great shock and a pulse of 140, followed by recovery without operation.

The stripping up of the retroperitoneal tissue by blood seems to cause shock out of proportion to the amount of blood lost. The great pain of a small injury will often produce pallor and collapse and cold extremities, while the pulse is quiet.

There is tremendous scope for the investigation of this subject, and work is being done, notably by Captain Geoffrey Marshall. It is not a question of preventing shock so much as of curing it, for it is impossible to apply the ordinary anti-shock procedure to a man before he is wounded. The clinical shock produced by sepsis is often very marked and may cause death in a comparatively few hours. This, again, is well seen in cases that are dying of gas gangrene of the limbs.

CARE OF THE PATIENT BEFORE OPERATION.

In transit to hospital.—First of all, a man, wounded in the abdomen, is more comfortable if he can be put in such a position that his abdominal muscles are relaxed. He should be covered up and kept as warm as possible and saved all the jolting possible, though, from the nature of things, this cannot be done very effectively. He should be given a reasonable dose of morphia—this will relieve his pain and mental anxiety. It is well to say a word here about the administration of morphia. After the first injection has been given a reasonable time should elapse before another dose is administered. This warning is necessary because patients have arrived at the casualty clearing station very profoundly under the influence of the drug. Not infrequently, too, the patient has been dosed either by himself or by his companions without the knowledge of the medical officer.

The withholding of water.—There is no reason why water should not be given in reasonable amounts; its withholding causes great distress to the patient, who very likely is already suffering from a lack of fluid in his body.

In hospital.—When a patient arrives at an operating hospital the question of immediate operation has to be considered. On the whole, it is better to put the man to bed and watch his condition for a little than immediately to subject him to operation. It is quite true that hæmorrhage is the great danger, but, still, my experience has led me to think that on the whole a little rest does more good than harm. The interval is used to improve the man's condition.

First and foremost as a remedial measure is the warming of the patient. This is by far the best treatment of shock that I know and far transcends in its importance the ministration of stimulants of whatever nature, either by the mouth or hypodermically. The radiant electric bath covering the whole body is by far the most efficient method of applying heat, and should be used wherever an electric current is available.

Fluid can be introduced into the system by the mouth, subcutaneously or intravenously: it just depends upon the state of the patient and his capabilities of reception. I would only say that the intravenous method is by far the best and surest and is the only way of any practical use if time is an object. The fashionable method of subcutaneous saline is practically valueless in a shocked man. Pituitrine is favoured by some people.

The actual moment for performing the operation must be left to the individual judgment of the operator. If the man does not respond at all, the question must be decided whether to operate at once or whether it is worth operating at all. Sometimes even as much as six or eight hours' rest will produce such improvement that an operation is possible where at first the case seemed hopeless.

GENERAL LINES OF TREATMENT.

Cumulative experience shows the wisdom of operation in most cases, and it is now mostly a question of excluding cases on which it is best not to operate. It can be frankly admitted that this line of treatment involves operating on certain cases which would have got well without operation. It also involves operating on a certain number of cases, such as those in which there is bleeding without visceral injury, which might have got well without operation, but there is no way of telling if the hæmorrhage has stopped except by looking.

In a certain number of cases the intraperitoneal hæmorrhage, although the hæmorrhage has ceased and is not immediately fatal, not infrequently leads to intra-abdominal abscess later on. On the whole, it may be said that a policy of "Look and see" is better than one of "Wait and see." It may be useful to enumerate those cases which are best left alone.

1. Cases in very bad condition. Now there are, of course, many cases which no surgeon would feel himself justified in operating on, but there are many border-line cases which some surgeons would leave and some to whom the surgeon would feel constrained to give the chance of operation. Here the personal equation comes in, and whether he operates or not must be left to the surgeon to decide. He should, however, remember the indications of Table IV. (Pulse-rates). It need only be added here that the bolder surgeon will most probably get a worse operative mortality.

2. Cases shot high up in the abdomen and in the liver area on the whole do very well if left alone, so long as there are no symptoms of hæmorrhage; in fact, hæmorrhage is the only reason for operating on liver cases. It is, of course, true that a certain number of these succumb to sepsis at the base, but their number is not sufficiently great to warrant early interference on that account.

3. High abdomino-thoracic wounds on the left side. The type of wound more especially referred to is that which enters somewhere near the mid-line behind and emerges somewhere towards the posterior part of the axilla about the level of the sixth to eighth rib. These wounds are sometimes accompanied by symptoms suggesting stomach involvement, but on the whole they do not do badly, and operative interference does not afford very much help, as wounds high up in the cardia, or near the œsophagus, are almost impossible to close; or, if they can be reached, involve such disturbances as to be likely to lead to a fatal result.

4. Cases arriving late. I am inclined to put down 24 hours as a usual limit within which a primary operation is likely to be successful. Hæmorrhage by this time has ceased and operation is only likely to spread infection if the bowel has been perforated and to hasten the end. There are some cases in which operation may be thought advisable—namely, those with a fair pulse but with vomiting, and the operation being performed with an idea of getting over the "obstruction" by short-circuiting or an enterostomy. The operations that I have seen performed for this reason have nearly all been fatal.

The so-called Murphy operation—that of simple suprapubic drainage—is, I believe, an absolutely useless disturbance, and has, I see, been abandoned by the French, with whom it was an official proceeding in the early days.

The operation table.—The Trendelenburg position should be ready for use. Most important is the provision of some heating arrangement on which the patient can lie.

INCISION.

1. *Its site.*—This must be planned rather with a view of dealing with the probable nature of the injury than with any reference to the wounds. With an in-and-out wound we know the course of the projectile and can form a fair estimate of the organs likely to be involved. With a single wound this is practically impossible, and it is here that an X ray apparatus is so valuable, as it enables us to make the abdominal incision in the best possible place.

To give an instance of the value of an X ray apparatus, suppose there is a single entry wound near the middle of the abdomen. Without an X ray apparatus the only thing is to open the abdomen in the middle line and find out the course of the bullet, and this involves an exploration of the whole abdomen; and in the end it may be found that the only viscus injured is the colon at its peritoneal reflection. The exploratory procedure will have exposed the whole abdomen to the danger of contamination. On the other hand, an X ray picture would have located the bullet in the loin and shown at once that a horizontal exploratory wound would have met all the circumstances of the case and possibly saved a life.

A paramedian incision is the standard method of opening the abdomen and it should be used in all cases unless there is some distinct indication to the contrary. It is always better to prolong it than to make lateral right-angle extensions. The length should be 6 to 8 inches, probably the longer is the better, as free access means a very great increase in celerity.

In some antero-posterior wounds towards the lateral line of the body a rectus sheath incision has something to recommend it; the colon can be more easily reached and the field of operation limited. It is not, however, a good incision to close and it divides many nerves. Both the hepatic and splenic flexures can be reached by the rectus sheath incision, the hepatic with a good deal more ease, however.

In those cases where the missile has perforated through the body from near the mid-line to the loin, whether this direction is shown by an entrance or an exit wound, or by the aid of a skiagram, the transverse incision either horizontal or parallel to the upper or lower abdominal limits, has much to recommend it. If more room is required it can be obtained by cutting the anterior rectus sheath, but leaving the rectus muscle intact. Such an incision allows free access to the hepatic and splenic flexures, to the vertical colons, to both kidneys, and to the spleen. It also allows a systematic examination of the small intestine, if necessary. It is the only incision that allows the ascending and descending colons to be easily and properly repaired and, in addition, its posterior extremity is a convenient situation for an artificial anus at the site of the colon wound. It is not a convenient incision for the stomach, except for that portion situated near the spleen.

A similar incision starting behind and prolonged forward, if necessary, can be used with advantage in exploring lateral wounds of the body in the neighbourhood of the cæcum and sigmoid. A subcostal incision is also good in certain liver wounds.

In some cases of wounds in the back of the loin it is better to open the abdomen in the mid-line and make sure that the peritoneum has not been involved. If this is so, the wound is closed and the loin opened up and the necessary steps taken to deal with the condition found. It is always very important when there is a possibility of a colon wound, to do everything to prevent contamination of the general abdominal cavity. Such horizontal wounds suture easily and heal kindly.

2. *Its closure.*—The method of closure must depend on the condition of the patient. If the condition is critical it must be closed by through-and-through sutures. If there is time an attempt should be made to close the peritoneum separately, as many of these wounds—more than one would like—suppurate, and it is impossible to prevent this suppuration extending to the intestines if the peritoneum is unsutured. If the condition of the patient allows it the wound can be closed in layers, but in every case there should be at least three through-and-through supporting stitches.

Suppuration in the operation wounds has been a trouble. It may be partly due to defective technique, but in many cases one has to remember that the blood in the abdomen, which must well out when the cavity is opened, is full of micro-organisms; and various methods have been tried to prevent infection, but with no great success. Of late, however, there seems to have been a certain amount of improvement. It is curious that the same condition of things is found on operating on acute appendix abscess, where the peritoneum can readily combat the septic condition in which it is left, while the abdominal wound falls a victim to the bacilli.

3. *Abdominal drainage.*—Opinions differ about this, and personally I never use it myself, nor do I believe that it has any points to recommend it. When speaking of abdominal drainage I mean the ordinary drain to the pelvis or flanks. It is quite another thing to tie a small local drain to a suture line which one mistrusts, the idea of which is to form a local track in the case of a leak.

4. *Flushing the abdomen.*—Some people favour this procedure and it has a good deal to be said for it when the abdomen is full of septic blood. At the same time it is difficult to do efficiently without much exposure of the intestines. In small local infections without blood it is not to be recommended. Both saline and eusol have been used, but to heat the latter to the requisite temperature is to destroy its efficiency. The cold produced by ether is sufficient to damn it, even if its use could cleanse the abdomen. A small amount used to produce leucocytosis finds favour with some.

POST-OPERATIVE TREATMENT.

I do not know that there is anything particular to be done to the patient after operation more than is done in ordinary surgical practice after any severe operation. The question of infusion or transfusion will naturally arise and in some cases may be beneficial. Most people treat their cases in a semi-recumbent position. As to the administration of morphia, it is better to give it than withhold it if the patient is restless or in pain. Most interest turns on the condition of the bowels. Castor oil, calomel, and pituitrine all have their advocates. There can be no doubt that pituitrine is a very fine purgative, especially if injected into the muscles; sometimes it requires to be helped by a glycerine enema. Like all other purgatives, it is dependent for its action on a healthy condition of the musculature of the bowels, and if this is paralysed either by shock or sepsis it will fail to act, as do other purgatives. I am not particularly anxious about the opening of the bowels, and I am fairly convinced in my own mind that the bowels will not give trouble if the case is

going to do well; and if the case is not going to do well—and it is mostly a matter of peritoneal sepsis—no purgative is of any real avail. I think I have seen a good deal of discomfort needlessly inflicted upon people by attempts to make the bowels act.

WOUNDS OF PARTICULAR ORGANS.

The Œsophagus.

Wounds of the œsophagus are very rarely seen, while wounds of the trachea are not so uncommon. The rarity of wounds of this tube must, I think, be due to the fact that antero-posterior wounds involve the spine and transverse wounds involve the great vessels. Some of the lower thorax wounds, which are accompanied by vomiting, may be wounds of the œsophagus, but there is really no proof of this.

One curious case may be quoted where a man was hit in the back about the fourth right interspace. He was treated for a thoracic wound as there were no localising symptoms. Two days later he passed the core of a bullet and the day following the mantle.

Stomach.

Organs wounded with the stomach.—The thorax is involved in a fair number of cases. The organs wounded with the stomach in order of frequency are the small gut, liver, colon, spleen, kidney, pancreas. One case may be quoted as showing how complicated these wounds may be. In this case the stomach, small gut, transverse colon, and sigmoid flexure were all wounded together. The complicated wounds are usually side-to-side wounds of the body, or such wounds with an up-and-down inclination.

I have seen one curious case in which the anterior wall was grooved and the spleen and the kidney also wounded. This ended fatally. A curious fact is the rarity with which wounds of the spleen and the stomach are met with in association, and when so associated are nearly always fatal.

Nature of wounds.—The stomach affords many types of wound, nearly all easily explained by the nature of the projectile and the course it takes. Sometimes the stomach wall is exposed by the carrying away of the anterior abdominal wall. At other times prolapse of the stomach takes place, accompanied by that of the colon, small gut, and spleen.

Bullets passing in an antero-posterior direction make small perforations. Shrapnel balls cause larger perforations, the edges of which are more excoriated than is the case with bullet wounds, the larger size and the rounder form of the ball causing a bruising of the wall before it bursts its way through. Shell and bomb fragments make wounds commensurate to their size and shape. When the axis of the flight of the projectile becomes more or less parallel to the walls of the stomach, the wounds become larger—sometimes a linear slit; sometimes a linear slit followed by a perforation to which the name of "note of exclamation" wound may be given. When the projectile passes in through the epigastrium and out by the axilla the slits may become more or less parallel to the greater curvature. When the missile passes in about the nipple line and takes a downward and oblique direction towards the right, the wounds are more or less at right angles to the greater curvature, so that the anterior wall of the stomach, or its antral portion, may be almost completely divided.

Projectiles hitting the greater or less curvature in an antero-posterior direction sometimes cause rather extensive V-shaped injuries involving both walls. Bruises or cuts in the peritoneum or muscular coats are also met with, and in one case a piece of hard clay which had perforated the spleen was found lying embedded in the stomach wall (Captain J. Fraser).

It is important to remember that the posterior wall may be alone wounded, or it may be wounded in conjunction with the posterior wall of the transverse colon. Both of these wounds may be invisible when the abdomen is opened.

The mucous membrane does not pout when the wounds are small, but in the case of linear wounds it becomes extruded, just as it does when one incises the stomach wall in doing a gastro-jejunostomy. The anterior wall is the wall most frequently wounded.

Bleeding.—Wounds of the stomach are accompanied by very severe hæmorrhage; this is a cause of death in a considerable number of cases. The hæmorrhage, as a rule, does not come from the actual wall, but from the vessels as they run up and down the surface of the organ. The hæmorrhage may take place either into the stomach or into the peritoneum.

Possibility of spontaneous recovery.—This has already been admitted, and it only remains to be said that a great many of the injuries could not result in this favourable termination.

Symptoms.—Vomiting is a very constant feature; in fact, the stomach is the only viscus which almost always furnishes this symptom. One is often surprised that vomiting is possible with the size of the wound in the organ. There is sometimes an escape of gas from the wound, but no particular diagnostic value is to be attached to the presence or absence of liver dullness.

Treatment.—Operation is to be advised in all cases except those cases already referred to where from the track of the bullet the wound is most probably situated near the œsophageal or upper portion of the cardia. The best incision is a paramedian one. As a rule, one can tell if the posterior wall is likely to have been involved. If this is the case, or if there is any doubt, the posterior surface must be explored through the gastro-colic omentum in the usual way. The suture of such wounds may be very difficult; as are wounds of the lesser curvature involving both surfaces. There is no need to excise the wounds unless they happen to be very ragged. Gastro-enterostomy may be necessary in cases of wounds dividing the antral portion or the duodenum, or in some cases of narrowing of the stomach. This should only be done in cases of very evident necessity.

Prognosis.—The maximum period of successful suture after receipt of the wound is 36 hours, and the prognosis depends largely on the amount of hæmorrhage that has taken place and on the association of other wounded organs. As was seen in Table I. (April 14th, p. 566), the mortality mounts very quickly in complicated wounds. The amount of peritonitis present does not depend very directly on the length of time between the injury and the operation.

Secondary complications.—A secondary hæmorrhage has proved fatal in an unsutured wound on the fifth day. Major T. R. Elliot and Captain Herbert Henry have made some important remarks on "After History of Both Operated and Unoperated Gastric Wounds."[2] They showed that sutured and non-sutured wounds, and contusions are subject to ulceration, secondary hæmorrhage, and perforation. Secondary hæmorrhage occurred on the sixth, twelfth, and fifteenth day respectively; death occurred on the ninth, twenty-sixth, and the twenty-fifth day; the first from hæmorrhage and the last two from peritonitis. Major Elliot thinks that this points to the necessity of careful feeding and especially to the withholding of extractives. Subdiaphragmatic abscesses have been met with, but were not common even in the preoperative days, according to Sir George Makins.

Mortality and cause of death.—The mortality can be judged from the tables. The causes of death are shock and hæmorrhage and peritonitis at a later period. The occurrence of many deaths from hæmorrhage teaches the lesson that stomach wounds cannot be considered as innocuous.

The Small Intestine.

Frequency.—The small gut was perforated in 363 cases in 965 operations. It is wounded by itself or in conjunction with nearly all other organs, but especially with the colon and stomach and bladder.

Character of the wounds.—The character of the small-gut wounds varies in some degree with the projectile that caused them, but not to the extent that one might expect. A bullet may inflict as severe an injury as a piece of high-explosive shell. It used to be thought that a patient shot with a bullet had a better chance than one injured by a shell fragment. The present war has proved this to be a mistake. As a matter of fact, the least severe wounds are caused by the small bomb fragments. The greatest number of lesions was 20, in a man who made a good recovery after resection of 6 ft. The greatest number of lesions sewn up successfully was 14.

Bullet injuries.—The injury may be complete or incomplete—i.e., it may open the lumen or it may only excoriate, bruise, or tear the outer coats. The most common injuries are the perforations made by the bullet striking the intestine at right angles to its long axis. Here there are two perforations through which the mucous membrane pouts to form a small round rosette. Some holes are said to be so small as

[2] Brit. Med. Jour., April 8th, 1916.

hardly to admit a bullet, and in such holes the mucous membrane does not pout. Apparently, as the flight of the bullet becomes more inclined to the transverse or long axis of the gut the perforations become slits, but there are still two separate wounds. These wounds gape somewhat, and the mucous membrane overlaps the cut muscular coat, so that a considerable mucous surface meets the eye. The general appearance still suggests a rosette. The two slits may enlarge until the continuity of the intestine is only maintained by two narrow strands of the wall.

In other cases there is only one wound involving different portions of the circumference of the intestine; it may reach from near the mesenteric border to near the free margin or involve the free margin only. In other cases the free margin is slit right back to the mesenteric border, so that only a narrow strip of wall remains. It is remarkable that the last piece to be divided is usually the attached portion. Here there is a wide gaping wound with an extensive exposed mucous surface. In extreme cases the gut is completely divided. In another extreme form of injury the intestine is only represented by a long narrow strip of bowel; its appearance suggests that some animal had gnawed or worried it.

The explanation of the transverse direction of the lesions is to be found in the looped arrangement of the small intestine whereby a greater part of the tube lies in a vertical direction. As a man is usually shot either from side to side or from before backwards, the missile will usually hit the intestine at right angles. If the bullet takes an up-and-down direction one meets with longitudinal lesions of the gut.

Shell fragments.—Shell fragments cause wounds of all varieties, generally commensurate to their size.

Shrapnel balls.—These cause large ragged perforations and tears.

Bombs.—Bomb injuries often cause small multiple wounds, and the same may be said of small fragments of high-explosive shell or a disintegrated bullet.

The cause of the eversion of the mucous membrane is, on the one hand, due to the redundancy of the mucous membrane, and also, apparently, from an examination of microscopic sections, to a retraction of longitudinal coat (Captain J. W. McNee and Captain J. S. Dunn). Microscopic examination of the wounded edges also shows that the lesion is a very local one; in fact, the appearances are no more than one would expect to see if the intestines had been cut with a pair of scissors—it usually consists of a blood infiltration in the neighbourhood of the wound. Mucous membrane stains well and distinctly right up to the very tear.

As many as 20 injuries may have to be dealt with. They may be even or uneven in number, and when uneven the projectile is often found within the gut or, if even, it may still be found lying in the last hole of exit. Very often the projectile is never found, remaining lodged in the body, or it may be passed per anum. As a rule, the injuries are found fairly close together, but if multiple they may involve a long extent of the intestine (9 ft.). In a few cases small lesions are distributed over the total length of small intestine. Sometimes a knuckle of gut is prolapsed and even strangulated in the abdominal wall. Sometimes the exposed knuckle is perforated, at other times it is intact, but there are perforations within.

Symptoms.—There is nothing more to be added to that which has been said under the heading of "Diagnosis of Intraperitoneal Damage."

Treatment.—A long paramedian incision is the rule, except in those cases which have been dealt with when the site of the incision was discussed. The actual operative technique in the abdomen is as follows. If present the blood must be got rid of and the bleeding stopped. As a rule, the whole length of the small intestine must be explored, with the possible exception of those cases of side-to-side wounds involving one-half of the abdomen where a transverse incision shows that the colon has been involved alone. If there is no blood and the length of the missile's track can be seen, it may be possible to exclude small-gut injury. The cæcum or duodeno-jejunum junction is first picked up and brought out of the wound; then the intestine is inspected, taking care to look at both sides; and the examined part is replaced within the abdomen. If a small hole is found and the gut beyond it for 6 or 8 inches is intact the hole is sewn up, one suture being, as a rule, sufficient. If the next lesion that is encountered is a small one the process may be repeated. If, however, the first lesion is a large one it is better to cover it up with gauze and a clamp and to proceed with the examination of the whole length, because a big lesion, if quickly followed by another, may necessitate resection, and the amount to be resected can only be determined when the total injuries are known.

When the small intestine has been dealt with the stomach is explored if there is any likelihood of its being injured, and the colon is dealt with last of all, as it is here that an artificial anus may be very likely necessary. If a horizontal incision is used it may be better to deal with the colon first, as thereby soiling of the peritoneum is minimised.

Turning to the question of suture *versus* resection, it may be said that small and discrete injuries mean suture, while multiple or severe injuries, especially if close together, mean resection. Resection is also necessary if four inches of the mesentery is destroyed or infarcted. In some cases double resections have been necessary where there were two badly injured portions of the intestine lying far apart.

I would advise that suture be practised on every possible occasion, even if there are two or three almost complete gashes, provided they are not too close together and so long as the gut remains undivided. It is better to narrow the gut somewhat than do a resection. The general tendency amongst operators has been to abandon resection.

Circular versus *lateral suture.*—It may be said that this old controversy is still unsettled; opinion sways backwards and forwards, and I cannot see from statistics that we have got that there is any difference. If lateral anastomosis is practised the lateral openings should be made a little way from the divided ends, because it is these divided ends which last recover their motility.

Primary short-circuiting or enterostomy.—The idea of these operations is to relieve the upper segment of the bowel which is liable to dilatation from a nervous or septic cause. It has by no means found universal acceptance, and I myself should not recommend it as a primary measure—it may be useful in some of the later operations. Naturally a small-gut anus is to be avoided whenever possible, but it may be the only thing to do.

Treatment of a prolapsed knuckle.—In the early days there was some difference of opinion on what was the best treatment for this condition. Nowadays with the establishment of the operative treatment there is no doubt that the right thing to do is to open the abdomen and deal with the lesions which are found.

Prognosis.—In the first instance one may say at once that wounds of other organs increase the gravity of the prognosis. Wounds of the duodenum have been so far very fatal, but with this exception there does not seem to be any difference between the jejunum and the ileum. Possibly it is more important to take greater care with the suture-line in the case of the jejunum in consequence of the presence of bile and pancreatic fluid. Some people think that the jejunal contents are more irritating and cause greater pain than those of the ileum.

Time factor.—This has been already dealt with and it only need be again mentioned that hæmorrhage is a great bugbear and causes early deaths. It may also have a distinct bearing on the later deaths from peritonitis by spreading infection in the abdomen. As regards sepsis, to judge from the peritonitis present, it may have made considerable headway in four hours and may be practically absent after 26 hours. As regards prognosis, more stress is to be laid on paralytic distension of bowel than on the amount of lymph or fluid effused.

Mortality and causes of death.—The mortality can be seen from the general table at the end of Lecture III. Death, when it occurs in a few hours, is due to shock and the results of hæmorrhage. When it occurs later it is caused by peritonitis, which usually ends fatally between the third and fifth day.

BRISTOL ROYAL INFIRMARY.—At the annual meeting the medical report showed that 4453 military in-patients were admitted to this institution. In addition, 3733 in-patients were treated, being an increase of 252 compared with 1915. The out-patients numbered 48,944. The financial statement showed the ordinary income was £15,472 and the ordinary expenditure £23,976. Bequests amounting to £40,891 had been received, being £35,586 more than in the previous year. The debt on the institution was now £14,802.

STUDIES IN WOUND INFECTIONS:
ON THE QUESTION OF BACTERIAL SYMBIOSIS IN WOUND INFECTIONS.

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FOR many years it has been recognised that one species of micro-organism may exercise a helpful action on the proliferation of another when the two are grown together in the same culture medium. Earlier examples of this type of symbiosis—the term usually applied to this phenomenon—are: (1) the growth of an anaerobic bacillus in association with an aerobe, (2) the growth of such a bacillus as *B. influenzæ* in association with either staphylococcus or *B. xerosis*.

With regard to the first example given above in which an aerobic micro-organism enables an anaerobic one to grow freely, the explanation usually given is that the aerobe in its growth absorbs the oxygen, thus making the conditions favourable for the proliferation of the anaerobe. This principle has been frequently employed in the cultivation of anaerobes and numerous ingenious methods have been devised for thus utilising the oxygen-absorbing properties of *B. subtilis* and other bacteria.

In respect to the second example given in which the growth of *B. influenzæ* is assisted by the presence of another micro-organism such as staphylococcus no such simple explanation can be given, but it is certain that the staphylococcus furnishes a substance which enables the influenza bacillus to flourish on a medium on which it will not grow alone, and also enables it to maintain its vitality for long periods.

In connexion with septic wounds of the present war the question of symbiosis may assume very considerable importance. In all these wounds the bacterial flora is a varied one consisting as it does of anaerobic and aerobic, spore-bearing and non-sporing bacteria. As has been shown by Fleming,[1] the primary infection of the wounds is a fæcal one. At first there is a phase in which the anaerobic spore-bearing bacilli (*B. perfringens* and organisms of putrefaction) flourish together with streptococci, *B. proteus*, and diphtheroids. The anaerobic bacilli as time goes on gradually disappear, and ultimately there remain streptococci, staphylococci, diphtheroid organisms, and, at times, *B. proteus*.

The microbes (apart from *B. tetani*) which directly cause the most serious infections are, in the early stages of the wound, *B. perfringens*, possibly *B. malignant œdema* and streptococci, while in the later stages streptococci are responsible for almost all the serious complications. Although the other microbes do not usually cause serious complications, their presence in the wound becomes an important matter if it can be shown that they may act as symbiotic stimulants to the growth of the more dangerous members of the bacterial flora. The experiments detailed below indicate that this is the case.

In order to approximate the conditions of the experiment to those obtaining in wounds the culture medium usually employed was human serum, either unaltered or serum to which sufficient trypsin had been added to neutralise the antitryptic power. The *raison d'être* of this procedure was that Wright has shown that, according to their situation, the bacteria proliferating in a wound have two varieties of culture media from which they obtain their nutriment.

(i.) Those proliferating in the cavity of the wound are supplied with a fluid medium which consists of the blood fluids altered to a varying degree by the breaking down of the extravasated leucocytes—a process which leads to the liberation of a large amount of trypsin. According to the amount of trypsin thus set free the antitryptic power of these blood fluids is either diminished, completely neutralised, or the resulting fluid is even—and this is by no means an unfrequent stage—rendered strongly tryptic. All these changes render the blood fluids a much more suitable pabulum for bacteria, for it has been shown that neutralisation of the antitryptic power of the blood serum completely destroys all the antibacterial properties of the blood, and the presence of free trypsin together with albumens obviously leads to the formation of digestion products which are the best of all foods on which to cultivate bacteria.

(ii.) Those bacteria proliferating in the lymph spaces of damaged but still living tissues are bathed in a fluid consisting of lymph altered to a much slighter extent, according to the time it has been exuded from the vessels, the number of leucocytes it contains, and other, at present, unrecognised factors.

PART I.—*Do the Other Microbes Present in a Wound Aid the Growth of* B. perfringens *?*

Fleming[2] in some preliminary experiments has shown that staphylococci, streptococci, and *B. proteus* when grown in association with *B. perfringens* caused an increased growth of this latter micro-organism.

Before proceeding to give the details of the various experiments the following points concerning the growth of *B. perfringens* in culture should be mentioned.

B. perfringens when planted into fresh serum and incubated under anaerobic conditions will only grow when the sowing is a heavy one.

Wright has shown that if the antitryptic power of the serum is neutralised by the addition of trypsin or its alkalinity is neutralised with an acid growth occurs with a much lighter sowing.

When growth takes place in serum a very large quantity of gas is formed, so that four to five volumes of gas may be produced from one volume of serum. This circumstance affords a convenient index of the presence and also of the amount of growth.

Experiment I. Influence of staphylococci and streptococci on growth of B. perfringens *in milk.*—A broth culture of *B. perfringens* was diluted with broth 10-fold, 100-fold, and by 10-fold steps to a million-fold dilution. 40 c.mm. of each dilution was planted into (*a*) milk, 1 c.c.; (*b*) milk, 1 c.c. + 20 c.mm. staphylococcus broth culture; (*c*) milk, 1 c.c. + 20 c.mm. streptococcus broth culture. These tubes having been incubated for 24 hours were examined for growth, which was indicated by the formation of the typical clot and gas formation. The results are shown in Table I.:—

TABLE I.

No. of tube and micro-organisms planted.	Dilution of *B. perfringens* broth cultures.					
	1/10	1/100	1/1000	1/10000	1/100000	1/1000000
(*a*) *B. perfringens* only	Gr.	Gr.	0	0	0	0
(*b*) ,, ,, + staphylococcus	,,	,,	Gr.	Gr.	Gr.	Gr.
(*c*) ,, ,, + streptococcus	,,	,,	,,	,,	,,	,,

Gr. = growth.

Experiment II. Influence of diphtheroid bacilli on growth of B. perfringens *in serum (with and without the addition of trypsin).*—In this experiment pieces of 6 mm. bore glass-tubing about 15 cm. long and sealed at one end were used as culture tubes. Into these miniature test-tubes the culture materials and micro-organisms were introduced and then melted vaseline was run on to the surface to form a column about 2·5 cm. high. The index of growth was gas formation evidenced by the vaseline being pushed up the tube. Dilutions of *B. perfringens* broth culture having been made, as in Experiment I., 10 c.mm. of each was planted into 300 c.mm. of serum. Another 10 c.mm. of each dilution was planted into a similar tube of serum which had been thickly sown with a diphtheroid bacillus. The experiment was then repeated, using serum to which sufficient trypsin had been added to neutralise the antitryptic power. The results are shown in Table II.

TABLE II.

No. of tubes and micro-organisms planted.	Dilution of *B. perfringens* culture.							Culture medium.
	1	1/10	1/100	1/1000	1/10000	1/100000	1/1000000	
(*a*) *B. perfringens* alone.	Gr.	Gr.	0	0	0	0	0	TS
(*b*) ,, + diphtheroid.	,,	,,	Gr.	Gr.	Gr.	Gr.	Gr.	
(*c*) *B. perfringens* alone.	0	0	0	0	0	0	0	US
(*d*) ,, + diphtheroid.	Gr	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	

Gr. = growth. TS = trypsinised serum. US = unaltered serum.

[1] THE LANCET, 1915, ii., 638.

[2] THE LANCET, 1915, ii., 376.

Two and a half hours after planting these cultures showed gas formation in the first tubes of series (*b*) and (*d*) and in four hours the amount of gas produced in the first tube of series (*b*) was equal in bulk to the culture fluid. Such rapid gas formation has not been noted under any other condition.

Experiment III. Do all the diphtheroids commonly present in wounds stimulate the growth of B. perfringens *to the same extent?*—Fresh human serum was divided into portions and each portion was planted thickly with a strain of a diphtheroid bacillus. The diphtheroid bacilli employed were representatives of the various groups frequently found in wounds.

Two hundred and fifty c.mm. of the serum containing the diphtheroid bacillus were distributed into miniature test-tubes, as described in Experiment II., and to each were added 50 c.mm. of dilutions, as shown below, of a *B. perfringens* broth culture (four days old). Vaseline was then poured on the top of the fluid and the tubes were incubated for five days. The results are given in Table III.:—

TABLE III.

Strain of diphtheroid used.	Dilution of *B. perfringens* culture.			
	1/1000	1/10000	1/100000	1/1000000
Forrest V.	Growth	Growth	0	0
Cation I.	,,	,,	0	0
Ford I.	,,	,,	0	0
Ryan I.	,,	,,	Growth	0
Beavan I.	,,	,,	0	0
Moore III.	,,	,,	0	0
Beavan IV.	,,	,,	Growth	0
Pretty V.	,,	,,	,,	0
Driscoll II.	,,	,,	0	0
Control*	0	0	0	0

* Without diphtheroid, *B. perfringens* only.

From the above table it will be seen that these diphtheroids all stimulate the growth of *B. perfringens* in serum and approximately to the same extent.

Experiment IV. Influence of a coliform bacillus and B. proteus *on growth of* B. perfringens *in serum.*—Similar small tubes to those used in former experiments were filled in as follows:—

Tube A. Serum 1 c.c. + *B. perfringens* emulsion 10 c.mm.
,, B. Serum 1 c.c. + *B. perfringens* emulsion 10 c.mm. + coliform bacillis emulsion 10 c.mm.
,, C. Serum 1 c.c. + *B. perfringens* emulsion 10 c.mm. + *B. proteus* emulsion 10 c.mm.

These tubes were incubated anaerobically for 18 hours and the number of *B. perfringens* estimated by counting against the number of the red blood corpuscles (Wright's method). The results obtained were as follows:—

B. perfringens per c.c.: Tube A, 62 millions; Tube B, 146 millions; Tube C, 357 millions.

Experiment V. To ascertain, when two microbes are grown in symbiosis, whether both are stimulated to increased proliferation.—The micro-organisms employed in this experiment were *B. perfringens*, staphylococcus, and streptococcus. Miniature test-tubes containing 1 c.c. of the fluid from an ovarian cyst were planted with cultures as shown below. After incubation under anaerobic conditions for two days, the number of microbes was estimated by counting them against the number of red blood corpuscles in a film (Wright's method) and also, in the case of the aerobic micro-organisms, by diluting and planting a known quantity of a dilution on to plates, which were then incubated under aerobic conditions, the resulting colonies being counted after a suitable interval. The results are given in Table IV:—

TABLE IV.

No. of tube.	Micro-organisms planted into the ovarian cyst fluid.*	No. of microbes per c.c. estimated by Wright's method after incubation.	No. of cocci obtained by plating 20 c.mm. of the fluid diluted 500 fold, after incubation.
I.	*B. perfringens* emulsion.	360 million.	—
II.	*B. perfringens* emulsion + staphylococcus emulsion.	*B. perfringens* 433 million, staphylococcus 880 million.	Innumerable colonies of staphylococcus.
III.	Staphylococcus emulsion.	400 million.	About 1500 colonies.†
IV.	*B. perfringens* emulsion + streptococcus emulsion.	*B. perfringens* 620 million, streptococcus 140 million.	265 colonies of streptococcus.
V.	Streptococcus emulsion.	50 million.	4 colonies of streptococcus.

* In each instance 10 c.mm. of emulsion was planted.
† Certainly less than half the number of colonies obtained from Tube II.

This experiment shows conclusively that when *B. perfringens* is grown in symbiosis with either staphylococcus or streptococcus the stimulation to increased growth is mutual to both species of bacteria.

Experiment VI. Influence of streptococci and staphylococci on the growth of B. perfringens *in serum.*—In this experiment the technique was modified by growing the cocci in serum for three days before planting the *B. perfringens*. Three small test-tubes, each containing 1 c.c. serum, were taken, one was planted with streptococcus, another with staphylococcus, while the third was left uninoculated. All three tubes having been incubated together anaerobically for three days an equal amount of *B. perfringens* culture was added to each. After a further incubation for 18 hours the number of *B. perfringens* were estimated by Wright's method.

Tube I. (staphylococcus + *B. perfringens*) contained 120 million *B. perfringens* per c.c.
,, II. (streptococcus + *B. perfringens*) contained 480 million *B. perfringens* per c.c.
,, III. (*B. perfringens* only) contained 62 million *B. perfringens* per c.c.

The above experiments show that the growth of *B. perfringens* is greatly increased when it is grown symbiotically with either streptococcus, staphylococcus, or various diphtheroid bacilli. It might be argued, however, that this increased growth was simply due to some simple action such as the neutralisation of the alkalinity or the antitryptic power of the serum, both of which, as mentioned above, have been shown by Wright to aid the growth of this bacillus. The following experiment shows, however, that the beneficial action of symbiosis with streptococci, diphtheroid, and a coliform bacillus is just as marked in the case when the serum, employed as culture medium, has previously been neutralised either in respect to its alkalinity or its antitryptic power.

Experiment VII.—The technique employed was similar to that used in Experiments II. and III.

TABLE V.

Series A.—In this series the culture medium consisted of serum 7 parts and distilled water 2 parts.

Micro-organisms planted.	Dilutions of *B. perfringens* culture.						
	1/1	1/10	1/100	1/1000	1/10000	1/100000	1/1000000
1. Control. *B. perfringens* only	Gr.	0	0	0	0	0	0
2. Diphtheroid bacillus + *B. perfringens*	,,	Gr.	Gr.	Gr.	Gr.	Gr.	0
3. Streptococci + *B. perfringens*	,,	,,	,,	,,	0	0	0
4. Coliform bacillus + *B. perfringens*	,,	,,	,,	,,	Gr.	Gr.	Gr.
5. *B. pyocyaneus* + *B. perfringens*	,,	,,	,,	,,	,,	0	0

Series B.—In this series the culture medium consisted of serum 7 parts and HCl N/10 2 parts (this amount of acid just neutralised the alkalinity of the serum).

1. Control. *B. perfringens* only	Gr.	0	0	0	0	0	0
2. Diphtheroid + *B. perfringens*	,,	Gr.	Gr.	Gr.	0	0	0
3. Streptococci + *B. perfringens*	,,	,,	,,	,,	Gr.	Gr.	Gr.
4. Coliform + *B. perfringens*	,,	,,	,,	,,	,,	,,	,,

Series C.—In this series the culture medium consisted of serum 7 parts, trypsin solution diluted 6 times, 2 parts.

1. Control. *B. perfringens* only	Gr.	Gr.	0	0	0	0	
2. Diphtheroid + *B. perfringens*...	,,	,,	Gr.	Gr.	Gr.	Gr.	0
3. Streptococci + *B. perfringens*...	,,	,,	,,	,,	,,	,,	Gr.
4. Coliform + *B. perfringens*...	,,	,,	,,	,,	,,	,,	,,
5. *B. pyocyaneus* + *B. perfringens*	,,	,,	,,	,,	,,	,,	0

Gr. = "Growth" and refers only to growth of *B. perfringens* as evidenced by gas formation in serum.

PART II.—*Do the Various Micro-organisms Commonly Found in Wounds Favour the Growth of Anaerobic Bacilli other than* B. perfringens?

Experiment VIII. Influence of streptococci on the growth of the bacillus of malignant œdema in serum.—A broth culture of malignant œdema was diluted by ten-fold steps up to a million-fold dilution. Of each of these dilutions 40 c.mm. were planted into a series of tubes containing 1 c.c. of serum and also into a series containing 1 c.c. of serum previously planted with streptococci. Vaseline was poured into the

tubes to make a column 2·5 cm. high and the tubes were then incubated at 37° C. for five days. The results then were as shown in Table VI. :—

TABLE VI.

Series of tubes.	Dilution of broth culture of malignant œdema.						
	1	1/10	1/100	1/1000	1/10000	1/100000	1/1000000
(A) Without streptococcus.	0	0	0	0	0	0	0
(B) With ,,	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.

Gr. = growth.

Experiment IX. Influence of diphtheroid bacilli, streptococci, and staphylococci on the growth in serum of the bacillus of malignant œdema and B. Hibler IX.—A quantity of serum was divided into two portions, one of which was implanted with the bacillus of malignant œdema, the other with *B. Hibler IX.* These implanted sera were now distributed in two series of minute test-tubes, 0·2 c.c. being added to each. One tube of each series was kept as a control, the others being further implanted with a different micro-organism. Melted vaseline was now poured on to the surface of the fluid and the tubes were incubated at 37° C. After varying intervals the tubes were examined for growth of the anaerobic bacillus which was demonstrated by the formation of gas. The results are shown in Table VII. :—

TABLE VII.

Other micro-organism planted.	Serum planted with the bacillus of malignant œdema.			Serum planted with *B. Hibler IX.*		
	Time of incubation in days—					
	3	5	9	3	5	9
None	0	0	0	0	Gr.	Gr.
Diphtheroid No. I. ...	Gr.	Gr.	Gr.	Gr.	,,	,,
,, No. II. ...	,,	,,	,,	,,	,,	,,
Streptococcus fæcalis ...	,,	,,	,,	,,	,,	,,
Staphylococcus	,,	,,	,,	0	,,	,,

From these two experiments it is seen that the ordinary non-sporing microbes found in wounds greatly stimulate the growth of the malignant œdema bacillus and *B. Hibler IX.*, both of which have been said to cause gas gangrene.

PART III.—*Do the Other Microbes Commonly Present in a Wound Favour the Growth of Streptococcus?*

As streptococcus is the cause of many of the complications, such as cellulitis or septicæmia, which occur even in the earlier stages of wounds and, in the later stages, is the one markedly pathogenic microbe, with the exception of staphylococcus, that is almost constantly present, any condition which favours its growth must be at once recognised as of great importance. In the earlier stages the associated microbes are usually *B. perfringens*, putrefactive anaerobic bacteria, *B. proteus*, and diphtheroid bacilli, while in the late stages it is associated with diphtheroid bacilli, *B. proteus*, and staphylococci.

Throughout these experiments in determining the amount of streptococcal growth the total number of cocci were counted by Wright's method or the number of living cocci were estimated by diluting the culture and plating out a known quantity of a dilution on an agar plate.

Experiment X. Influence of B. perfringens *on the growth of streptococcus.*

Tube I. 1 c.c. fresh human serum planted with 10 c.mm. streptococcus emulsion.

,, II. 1 c.c. fresh human serum planted with 10 c.mm. streptococcus emulsion + 40 c.mm. *B. perfringens* broth culture.

After incubation for 18 hours under anaerobic conditions the number of streptococci was counted by Wright's method.

Tube I. (streptococcus only) contained 100 million streptococci per c.c.

,, II. (,, + *B. perfringens*) ,, 360 ,, ,, ,,

Experiment XI. Influence of B. perfringens *on growth of staphylococci and streptococci.*—Four tubes, each containing 1 c.c. of serum, were taken. Two of them were planted with *B. perfringens*, the other two remaining unplanted. After all the tubes had been incubated together for 24 hours under anaerobic conditions an equal quantity of staphylococci culture was planted into one of the unplanted tubes and into one of the *B. perfringens* cultures. The remaining tubes were similarly planted with streptococcus. After having been incubated under anaerobic conditions for 24 hours each culture was diluted 1000-fold with broth, and 10 c.mm. of this dilution was distributed on to the surface of an agar plate. These plates were incubated under aerobic conditions, and the resulting colonies of streptococcus or staphylococcus were counted. The results are shown in Table VIII.:—

TABLE VIII.

Tube I. (*B. perfringens* + staphylococcus) gave about 600 colonies of staphylococcus.

,, II. (Staphylococcus only) gave 64 colonies of staphylococcus.

,, III. (*B. perfringens* + streptococci) gave about 1000 colonies of streptococci.

,, IV. (Streptococci only) gave 1 colony of streptococci.

When it is considered that both streptococci and staphylococci grow much more readily in unaltered serum than *B. perfringens* this enormous stimulation of growth is all the more surprising.

Experiment XII. Effect of diphtheroid bacillus on growth of streptococci.—Into each of three small test-tubes 1 c.c. of serum was placed. To the first was added 10 c.mm. of 1000-fold diluted broth culture of a streptococcus; to the second 10 c.mm. of 1000-fold diluted broth culture of a diphtheroid bacillus; and to the third 10 c.mm. of the 1000-fold diluted streptococcus culture and 10 c.mm. of the 1000-fold diluted diphtheroid bacillus culture. The number of living micro-organisms in each tube was then estimated by plating out a known quantity on agar and counting the resulting colonies. The three tubes were then incubated for 10 hours at 37° C., after which the number of living micro-organisms was again estimated by the same method. The results are given in Table IX. :—

TABLE IX.

No. of tube and implantation.*	Content of living streptococci per c.c.		Content of living diphtheroid bacilli per c.c.	
	At time of planting.	After 10 hours incubation.	At time of planting.	After 10 hours incubation.
1. Streptococcus culture ...	13,000	2,800,000	—	—
2. Diphtheroid culture	—	—	2000	5,300,000
3. Streptococcus culture and diphtheroid culture ...	13,000	120,000,000	2000	2,600,000

* In each instance 10 c.mm. of broth culture diluted 1000-fold.

This experiment shows a very great increase in the numbers of streptococci in Tube 3 where streptococci are grown in association with diphtheroid bacilli. In this tube there was after 10 hours more than 40 times as many streptococci as in an exactly comparable tube where the streptococcus was grown by itself.

Association with streptococci did not appear to favour the growth of the diphtheroid bacilli; on the other hand, it seemed to retard it, as there were only half the number of living diphtheroid bacilli in the tube containing the mixed culture as there were in the tube in which the diphtheroid bacillus only had been grown.

With regard to the mechanism by which the aerobic organisms help the anaerobes the following experiment is of interest.

Experiment XIII.—An ordinary broth culture tube was incubated with a diphtheroid bacillus such as is commonly found in wounds. The cotton-wool plug was cut off short and pushed a little way down the tube. Melted vaseline was now poured on the plug so as to soak into it and to leave a layer of vaseline about 0·5 cm. thick on the top. The tube was put in the incubator, and when it had reached incubator temperature a mark was made at the upper level of the vaseline. As oxygen was absorbed from the tube so the vaseline was sucked down, and at intervals marks were made corresponding with the level of the vaseline.

The height of the column of air in the tube was 87 mm.

In 6 days the vaseline was sucked down 7·5 mm. = 0·09 of total volume
In 10 ,, ,, ,, ,, 13·5 mm. = 0·15 ,, ,,
In 4 months ,, ,, ,, 17·5 mm. = 0·2 ,, ,,

We see, then, that ultimately the amount of gas absorbed was 0·2 of the total volume, which corresponds with the amount of oxygen in air, and the absence of oxygen was confirmed by the introduction of pyrogallic acid and caustic soda, when no further absorption took place and no brown colour was produced.

Further experiments showed that staphylococcus, streptococcus, *B. pyocyaneus*, and some coliform bacteria absorb oxygen to a greater or less extent during their growth.

While this oxygen absorptive power may play some part in the symbiotic action of aerobic bacteria on the anaerobes, yet it cannot be the only explanation, as the experiments cited above show that the stimulant action of the "aerobic" bacteria is exercised when the cultures are grown under absolutely anaerobic conditions.

Summary and Conclusions.

Part I.—The experiments described show that:—

(i.) The proliferation of *B. perfringens* is much more rapid when it is grown in symbiosis with streptococcus, staphylococcus, various diphtheroid bacilli, *B. proteus*, *B. pyocyaneus*, and a coliform bacillus.

(ii.) Such increased growth occurs equally well when the culture medium consists of fresh serum or of serum which has been neutralised either in respect of its alkalinity or its antitryptic power, indicating that the increased proliferation in fresh serum cultures is not due to either of these changes taking place.

(iii.) All strains of diphtheroid bacilli, commonly isolated from wounds, were found to be practically equally efficient in stimulating the growth of *B. perfringens*.

(iv.) Not only were a much larger number of *B. perfringens* found in the cultures grown in symbiosis with these various bacilli after a certain period of incubation, but it was also found that an almost infinitely smaller number of *B. perfringens* would proliferate under these conditions than when pure cultures were made.

(v.) When *B. perfringens* and streptococci are grown in symbiosis a much more abundant growth of *both* microbes results.

Part II.—The experiments detailed show that:—

(vi.) Nos. (i.), (ii.), and (iv.) of the above conclusions applied equally when the bacillus of malignant œdema or *B. Hibler IX.* was substituted for *B. perfringens*.

Part III.—The experiments described show that:—

(vii.) *B. perfringens* when grown in symbiosis not only with streptococci, but also with staphylococci, leads to an enormous increase in the number of cocci found in the culture.

(viii.) Streptococci grown in symbiosis with diphtheroid bacilli gave a much more abundant growth than when grown in pure culture. The growth of the diphtheroid bacilli in the mixed culture was, however, 50 per cent. less than in the pure culture.

(ix.) The final experiment shows that diphtheroids and many other bacilli have the power of absorbing oxygen to a greater or less extent during their growth, but that this property will not account entirely for the increased proliferation that occurs, when aerobes and anaerobes are grown in symbiosis, since similar mixed cultures placed under anaerobic conditions show quite as marked an increase of growth.

These experiments indicate that bacterial symbiosis may play a very important rôle in wound infections. For as regards gas gangrene, which is caused by the invasion of the tissues by certain anaerobic bacilli, the commonest being the *B. perfringens*, it is well known that very large doses of pure cultures of this bacillus have to be inoculated into animals in order to produce this disease with certainty; again, Wright has shown that to obtain a growth of this bacillus in serum a very heavy impiantation is necessary, but if the serum is altered by neutralisation of its alkalinity or its antitryptic power a very much smaller sowing will produce an abundant culture. From these experiments he concluded that the conditions leading to such an alteration of the blood fluids play an important part in the production of gas gangrene.

Taking these facts into consideration, together with many of the clinical aspects of gas gangrene, it would seem apt to compare the action of *B. perfringens* in the production of this disease with a high explosive which is comparatively harmless until the explosive action is started by a detonator. Keeping this simile in view, it is obviously of the utmost importance to ascertain those conditions which act as "detonators" in the growth of this bacillus, and the experiments detailed above show that over and above those factors which have been described by Wright there is another—namely, symbiosis—and that this is in *in vitro* experiments the most important as yet described, since the growth of *B. perfringens* obtained in serum under such conditions is not only much more rapid in development and more copious in quantity, but also follows the lightest implantations.

These results would, for example, explain the occurrence of gas-gangrene in those cases where the number of bacilli introduced into the wound at the time of its infliction was comparatively small. They would also explain the frequent occurrence of gas-gangrene in those cases in which after a thorough cleansing and opening up of the wound—a procedure which should reduce the infection to a minimum—free drainage is prevented either by suture or unsuitable dressings. Again, these experiments would explain the almost "explosive" onset of gangrene in some of the severe, heavily infected wounds, for the results obtained in Experiment II., in which, within four hours, gas equivalent to the volume of the serum used as a culture medium was produced, indicate a rate of growth which has never been approached under any other conditions.

These experiments show also that the streptococci multiply much more rapidly when grown in symbiosis with various bacteria, amongst these being the group of diphtheroid bacilli which are present in practically every infected wound from the earliest stage until cicatrisation is complete. Such being the case, it is very probable that symbiosis plays an important part in the production of cellulitis and similar complications due to streptococci occurring in the earlier stages of the wound, and also accounts for the common occurrence of the severe inflammatory reactions which so frequently follow operative interference in the later stages of the wound.

CLINICAL TYPES OF SUBTERTIAN MALARIA

AS SEEN IN SALONIKA IN SEPTEMBER, OCTOBER, AND NOVEMBER, 1916.

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DURING last September, October, and November we had an opportunity of seeing over 3600 cases of malaria. The diagnosis of malaria has been founded either on a positive blood finding or on the history of the case, temperature chart, and a definitely hard palpable spleen. In a small proportion of the cases other infections were present in addition. In isolated cases a double infection with subtertian and quartan parasites was found. Owing to the fact that in some 40 per cent. of the cases we were unable to demonstrate the parasites in the peripheral blood stream we are not in a position to give exact figures of the relative amounts of benign and subtertian infections, but there can be no doubt that during this period the percentage of subtertian infections was very high. The relatively high proportion of the negative blood finding is due to the fact that practically all the patients were under the influence of quinine on admission to the hospital and many of them had been several days under hospital treatment before admission to a base hospital. Further, owing to pressure on beds, it was generally impossible, in the less severe cases, to make more than one blood examination.

The majority of the cases were of the simple subtertian, double subtertian, and irregular types of subtertian pyrexia without local manifestations. These cases uniformly responded well to treatment with quinine. The most important group of cases with local symptoms, on account both of relative frequency and of difficulty of differential diagnosis, were characterised by more or less urgent gastro-intestinal symptoms. This group could be separated into several more or less definite types.

Dysenteric.—A large number of the cases were sent into hospital with a diagnosis of dysentery. A prominent symptom was the presence of diarrhœa. The great majority of the patients stated they were passing "blood and slime," but this is a mere formula with most of them and of no value in diagnosis. In most of these cases the stools were fluid and fæculent, without definite blood or mucus, and they varied

in number from 6 to 15 or more in 24 hours. These cases rapidly improved under quinine. In a smaller number of cases the stools contained definite blood and mucus. It was possible in the great majority of these cases to demonstrate a superadded infection with one of the organisms of the dysenteric group. In a few other cases patients admitted with malaria but without dysenteric symptoms developed genuine bacterial dysentery; and again, cases with bacterial dysentery, after a few days in hospital, showed genuine malaria with protozoa in the blood. In a few cases where the diarrhœa tended to persist concurrent infections with *Lamblia intestinalis*, *Tetramitus*, *Trichomonas*, and *Balantidium coli* were demonstrated. Apart altogether from these cases there were a considerable number of patients admitted whose dominant symptom was diarrhœa, and in whom repeated examinations of the stools failed to demonstrate any dysenteric organisms or amœbæ. Several of these cases died, and the autopsy showed, in some, slight congestion of the colon, chiefly in its upper part; in others, definite small submucous hæmorrhages; and in one, to be described in detail, extensive submucous hæmorrhages, but a perfectly intact mucous membrane. In many of these cases the bowels moved at first from 20 to 30 times a day. The stools were liquid, fæculent, and not unlike Worcester sauce. In the majority this diarrhœa very speedily subsided under energetic quinine treatment. In some the stools were fæcal, liquid, more or less heavily tinged with blood, and, very characteristic, notably bile-stained. This stool, although containing blood and traces of mucus, is yet macroscopically quite distinct from the typical dysenteric stool. As examples of those types we may quote the following cases:—

Corporal F., aged 32, admitted on Sept. 20th, 1916, with profuse diarrhœa and pyrexia. The bowels were moving about every hour; stools fluid, fæculent, and heavily tinged with bile and blood. Spleen enlarged and hard; blood film showed very heavy infection with subtertian parasites of all types, rings, rosettes, and crescents. He was treated with intravenous quinine and salines. The stools were examined for organisms of dysenteric group and protozoa with a negative result. The diarrhœa continued, the stools constantly containing blood and traces of mucus. Ultimately he became incontinent and died eight days after admission. Post mortem, spleen was enlarged to four times normal size. Large intestine showed moderate congestion with small punctate submucous hæmorrhages; no ulceration, and whole mucous membrane smooth and glistening.

Sergeant B., aged 24, sent into hospital on Sept. 2nd, 1916, with history of having been unwell for nine days, at first with constipation, abdominal pain, and vomiting. Three days before admission he began to suffer from severe diarrhœa. On admission he was collapsed and bowels moving every half hour; stools liquid, fæculent, and heavily stained with blood and bile. Marked icteric tinging of sclerotics. The blood showed the presence of numerous subtertian rings. The diarrhœa continued and ultimately the motions appeared to consist of almost pure blood. Post mortem, the whole of large bowel showed a microscopically intact smooth glistening mucous membrane without any suggestion of ulceration. Extensive submucous hæmorrhages were present throughout whole of large bowel.

Choleraic pernicious fever.—Fortunately only two cases of this type were met with. Both cases died within 15 hours of admission in spite of intravenous quinine and salines.

Private K., admitted on Sept. 14th, 1916, from a camp alongside our lines. On admission was in state of profound collapse, with subnormal temperature, sunken cheeks, blue nails, and cold, cyanotic extremities. Mentally he was dull, and it was difficult to get a history, but it appeared he had not been well for two days, although he remained on duty till day of admission. Parasites not found in blood film. There was incontinence of fæces, and a watery brown fluid without visible blood or mucus continued to ooze from anus. He died within 12 hours of admission. Post mortem, spleen was slightly enlarged and almost diffluent. Colon and sigmoid flexure presented moderate congestion but no trace of ulceration. Smears from spleen, after prolonged search, showed rings and crescents of subtertian malaria.

The other case was exactly similar except that it was a second attack and that the parasite was readily found in the blood.

Appendicular type.—Cases strongly suggesting appendicitis have not been infrequent. In all we have seen some 12 cases of this type. The chief complaint was vomiting and severe pain referred to the right iliac fossa, associated with moderate pyrexia and marked tenderness and rigidity in the right iliac fossa. In most of the cases it was possible to show that the rigidity was not constant. In some of the cases the tenderness was most marked somewhat above McBurney's point; in others it corresponded accurately with this point. In all of our cases we were able to demonstrate either the presence of the parasite in the blood or a definite enlargement of the spleen. None of our cases showed a leucocytosis, and all had the typical relative lymphocytosis of malaria. All rapidly cleared up under quinine treatment. We have also seen a few cases in which the abdominal pain and rigidity were so marked and so diffuse as to suggest an acute abdomen, but these also rapidly cleared up under the use of quinine with the exception of one case which was complicated with septicæmia. This at the autopsy showed a purulent pleuritis and peritonitis, in the exudates of which streptococci were demonstrated.

Bilious remittent fever.—Thirteen of our fatal cases were of this type. These cases had all been ill several days before admission to the base hospital. On admission they were collapsed, with marked yellowing of the conjunctivæ and a peculiar earthy facies. They suffered much from almost constant vomiting, and the majority from bilious diarrhœa and mental confusion. After treatment by intravenous quinine and intravenous saline they improved from a condition of apparently extreme urgency to one of relative comfort, but, unfortunately, the improvement was not maintained, and after a period of from two to five days their condition again became critical. The jaundice became deeper, the vomiting, often accompanied by uncontrollable hiccough, again became severe, the bowels incontinent, the temperature rose, and they died in coma or delirium. The chief macroscopic features post mortem were enlargement of the spleen and submucous hæmorrhages in various organs, and the presence of a gall-bladder distended with thick dark bile.

Pernicious fever with pulmonary symptoms.—Both numerically and as a cause of death the next most important group was that in which the patients' dominant symptoms were referred to the respiratory tract. Of the cases of malaria which terminated fatally, pulmonary complications of a pneumonic or broncho-pneumonic character were present in 7, and were the immediate cause of the fatal issue. Amongst the patients admitted to the hospital were a large number who complained of respiratory symptoms, and some who were admitted under the varying diagnoses of bronchitis, broncho-pneumonia, and congestion of the lungs, were found subsequently to be suffering from subtertian malaria. In them the malarial parasite could be demonstrated in the blood. Amongst these cases were a small proportion who, in addition to their malaria, gave a history and presented the physical signs of a chronic bronchitis and emphysema, and in them the occurrence of a malarial attack caused a decided increase in their symptoms and physical signs. In the majority of cases, however, there was no history of bronchitis nor any evidence of emphysema. Amongst these the pulmonary complications could be divided into the bronchitic, the broncho-pneumonic, and pneumonic.

The bronchitic type.—The patients complained of pain and tightness in the chest with persistent cough, accompanied by expectoration. They presented the ordinary signs of a diffuse bronchitis with numerous rhonchi and râles scattered all over both lungs. Some showed the typical malarial pyrexia, others an irregular intermittent pyrexia, while others ran a normal or subnormal temperature throughout their stay in hospital. They differed from an ordinary bronchitis, only in the presence in the blood of the malarial parasite, and their rapid response to treatment by quinine. It is not suggested that the bronchitis is caused by the malarial parasite, and it may be that the bronchitis is nothing more than that which is usually associated with the onset of any acute febrile illness. Nevertheless the respiratory symptoms are so well marked and the patient's complaint is so entirely referred to his chest that one is, we think, justified in separating out a definite clinical group—the bronchitic.

The pneumonic and broncho-pneumonic type.—The term pneumonic is not strictly accurate for the whole of this group of cases, and all that it is meant to convey is that we are dealing here with a group of cases in which the physical signs suggest that there are in the lungs areas of more or less extensive consolidation, some definitely lobar, others lobular or confluent lobular. To this group belong the fatal cases

already referred to. In all of these seven cases subtertian parasites were demonstrated in the blood, and in all were definite physical signs, in some lobar, in others lobular consolidation. Of these seven cases at autopsy four showed definite lobar consolidation of one or more lobes, complicated in two cases by hæmorrhagic pleurisy. These showed the ordinary macroscopic appearance of lobar pneumonia in the grey hepatic stage. In the other three cases there was extensive lobular consolidation of both lungs. In one case there was present, in addition to the broncho-pneumonia, 12 ounces of blood-stained serous fluid in the pleural cavity. In both these groups we would appear to be dealing with a superadded infection, in which the malarial parasite was at the most but a predisposing cause. It is worthy of note, however, that during this period only one case of pneumonia unassociated with malaria was admitted.

A third group comprised a series of cases which from the onset of the illness presented definite pulmonary physical signs and symptoms which pointed to areas of definite consolidation in the lungs, though the course of the disease was not that of a true lobar or lobular pneumonia. Two cases are described in detail. In both subtertian parasites were demonstrated in the blood.

Private F., aged 20, reported sick on Oct. 22nd, 1916, complaining of shivering, malaise, and diarrhœa. Admitted to hospital on the 29th. He was pale, with slight icteric tint of sclerotics. The spleen was three fingers' breadth below costal margin. Over left lower lobe posteriorly there was evidence of consolidation with bronchial breathing and numerous medium-sized moist râles. Anteriorly there was bronchial breathing in second, third, and fourth left intercostal spaces. No definite dullness on percussion either anteriorly or posteriorly and vocal resonance and fremitus not markedly increased. The lung condition remained practically unchanged until Nov. 13th, when the breath sounds lost their bronchial quality, became a little weak, and a friction rub developed over the left lower lobe posteriorly. On day of admission temperature rose to 103° F., pulse to 112, and respirations to 32. Next day temperature did not rise above 99°, but on following day again rose to 103°. It fell again on the subsequent day and then remained normal. The pulse-respiration ratio was not at any time much disturbed. There was little cough and no expectoration. He was treated with 20 grains of quinine intramuscularly twice a day for the first six days, and then by 20 grains intramuscularly and 40 grains by mouth for the next seven days.

Lance-Corporal I., aged 29, reported sick on Nov. 1st, 1916, complaining of pain in chest, headache, and shortness of breath, no shivering. On the 4th he was admitted to hospital with diagnosis of congestion of lungs. He did not have the general appearance of pneumonia nor did he look very ill. Dyspnœa was evident only on exertion. Spleen just palpable. Whole of right lung was involved. Anteriorly breath sounds above and below clavicle were bronchial and all over anterior aspect of lung were numerous moist sticky râles. Movement was diminished, but no appreciable percussion dullness. Posteriorly there was slight percussion dullness over right supraspinous fossa and over right base. Breath sounds over supraspinous fossa were bronchial and in a small area just below spine of scapula distinctly tubular. Numerous râles were present all over right lung and a few râles at left base. On admission temperature 99·8° F., pulse 96, respirations 36. On following day temperature was again 99·8°, falling on third day to normal. On the fourth day his general condition became worse. The temperature rose to 102·8° and for two days he lay in a curious state of wandering delirium. His temperature fell on the following day and did not rise above 99° at any other period of his illness. During the sudden rise in temperature the pulse was 84 and respirations 30, showing a distinct disturbance of pulse-respiration ratio. The signs over right side of chest gradually diminished, but on the 12th, without any rise of temperature or any increase in symptoms, a large area of consolidation was found over the left lower lobe posteriorly, accompanied by numerous moist râles. On the 27th the right lung was completely clear, but the left lower lobe still showed bronchial breathing and râles. At no time was there any expectoration. Treatment was carried out with quinine by mouth.

These cases have been detailed because, although the chest signs and symptoms were perfectly well defined, suggesting a lobular consolidation, the course of the disease was certainly not that of lobular pneumonia. One of the cases showed a disturbance of the pulse-respiration ratio, the other did not. Neither case had any expectoration. In neither case was the temperature chart that of a pneumonia, but was certainly characteristic of a malarial attack. In both cases subtertian parasites were found in the blood. The character of the pulse remained good throughout the course of the disease, and at no time were the patients seriously ill. It is difficult to suggest what the exact pathological condition in those cases is, but we consider there is no doubt that there is a clinical type of malaria associated with the physical signs of more or less extensive consolidation of the lungs, in which there is no evidence whatever of a superadded infection. This type may be conveniently designated the pneumonic.

Cerebral cases.—An extremely interesting, but relatively small, group of cases presented cerebral symptoms of the well-recognised cerebral types, but, as we intend to describe these later in detail from the point of view of treatment, we will only briefly mention them here. In all we have had nine cases in which the dominant symptoms have been due to local affections of the nervous system. Two of these were of the bulbar type and showed temporary paralysis of the muscles supplied by the bulbar nuclei; both recovered and were discharged from the hospital without any evidence of organic disease. One patient was admitted with a diagnosis of debility. Twenty-four hours after admission he suddenly became comatose and remained so for 15 hours. He also completely recovered. One patient 21 hours after admission, while in the latrine, developed an epileptiform fit. These fits, which were of a general epileptiform character, were repeated about 12 times in the following 24 hours. The left leg became somewhat weaker than the right and developed an extensor plantar reflex, which at the time of writing is still present. In addition the patient still presents definite nystagmus and a tendency to a reeling gait, but no evidence of active disease. In four cases the most marked symptom was violent delirium, which persisted for several days uninfluenced by variations in the temperature. In three of the cases there was a high, intermittent pyrexia, in one the temperature was never above 99° F. In all the cases subtertian parasites were demonstrated in the blood and all the cases completely recovered. One patient presented meningitic symptoms associated with pneumonia at the right base This patient died. The autopsy showed a considerable excess of cerebro-spinal fluid beneath the tentorium with œdema of the pia-arachnoid over the base, and congestion of the vessels over the pons. Section of the brain after hardening in formalin showed no evidence of gross brain disease The middle and lower lobes of the right lung presented the features of an ordinary croupous pneumonia.

Generalised œdema with ascites.—Two cases were admitted complaining of breathlessness and having generalised œdema.

Driver W., aged 35, reported sick on Oct. 6th, 1916, complaining of breathlessness, swelling of feet, legs, and face, and headache. Admitted to hospital on the 9th. On admission there was considerable œdema of hands, feet, and legs, and eyelids were puffy. Visible mucous membrane almost colourless; some lemon-coloured tinting of sclerotics. Abdomen notably distended, subcutaneous tissues œdematous, and all the characteristic signs of a considerable accumulation of free fluid in peritoneal cavity. The spleen extended almost to umbilicus; liver not enlarged. Slight mitral systolic murmur, rate of pulse 78, and rhythm of heart normal. Apex beat in fourth space in nipple line. Nothing abnormal was made out in the lungs. The urine was of a specific gravity 1012, clear, straw-coloured; no albumin, bile, or sugar; deposit showed a few uric acid crystals, but no casts. Temperature normal on day of admission (Oct. 9th), but rose to 103° F. on evening of 10th, to fall on morning of 11th to 99·8°. From the 15th onwards temperature remained normal. Blood film showed presence of subtertian rings and crescents. Treatment by intravenous quinine was commenced on the 10th and later continued intramuscularly and by mouth. On the 12th condition was immensely improved; œdema of feet and hands had almost disappeared, and it was no longer possible to demonstrate free fluid in abdominal cavity. On the 16th the blood was free from parasites, and he was discharged to hospital ship on the 23rd.

Private B., aged 25, reported sick on Oct. 27th, 1916, complaining of swelling of legs and breathlessness; previous to present illness had always been healthy. He was admitted to hospital on the 27th. On admission patient presented notable œdema of legs and of subcutaneous tissues of back and abdomen, and eyes were puffy. Visible mucous membrane pale; slight lemon tint of sclerotics. Abdomen considerably distended and gave all the characteristic signs of

free fluid in abdominal cavity. Spleen extended almost to umbilicus; lower margin of liver half an inch below costal margin. Apex beat of heart in fifth space almost in nipple line; pulse-rate 96, rhythm normal; second pulmonic sound not definitely accentuated. Nothing abnormal made out in lungs. The urine did not contain albumin or casts. Blood film showed presence of subtertian crescents and rings and red blood cells marked anisocytosis and polychromatophilia. Temperature normal and remained so. Patient treated at first with intramuscular quinine and later with quinine by mouth. By Nov. 11th œdema of extremities and physical signs of ascites had completely disappeared. He was discharged to a hospital ship on Nov. 15th.

In these two cases we have the presence of œdema of the face and extremities and notable ascites without any evidence of either primary heart or renal disease. Both cases showed the presence of subtertian parasites, and both very rapidly cleared up under quinine treatment. Apart from the absence of any evidence of heart disease the distribution of the œdema, affecting the face, and the presence of a notable amount of ascites without enlargement of the liver are sufficient to exclude a cardiac origin for the œdema. Similarly the presence of a perfectly normal urine in both cases excludes a renal origin. We would suggest that the œdema is of toxic vascular origin similar to the œdema and ascites seen in the late stages of multilobular cirrhosis of the liver.

Gangrene of the feet.—Another group, consisting of three cases, showed evidence of local vascular changes in the development of gangrene of the toes.

Private B., A.S.C., aged 26, admitted to hospital on Oct. 4th. Reported sick on Oct. 1st, complaining of loss of use of legs and numbness of feet. He stated that he had not been unduly exposed before reporting sick. On admission to hospital temperature was 102° F., conjunctivæ slightly icteric, and spleen palpable. Blood film showed presence of numerous subtertian parasites. He complained of very severe pain in both feet, shooting up the legs; both feet were considerably œdematous, and over dorsum of each foot was a large purple ecchymosis. The great toe and all smaller toes of right foot and the small toes of left foot were slightly swollen and almost black in colour. On soles of both feet, from bases of toes backwards for a distance of about one inch, the skin was purple in colour. Sensation to gross touch was still present; the dorsalis pedis and posterior tibial arteries of both feet could be felt pulsating quite strongly. As it was considered possible that a vascular spasm aggravated by quinine might be a factor in the condition, the patient was not given quinine, but was treated with 0·4 gm. galyl intravenously. Next morning the temperature had fallen to normal, and remained so for the remainder of the patient's stay in hospital. The general condition steadily improved; blood reported negative to malaria on the 10th. The feet rapidly improved, and apart from slight superficial necrosis on dorsum of right foot completely recovered. On Oct. 14th he was put on 20 grains quin. sulph. daily by mouth and was discharged to hospital ship on the 28th.

Private M., aged 24, admitted to hospital on Oct. 11th. Reported sick on Oct. 5th, complaining of shivering, pains in head and back. For three weeks before reporting sick his company had been resting behind the line. On Oct. 7th when taking off his boots he noticed that his feet were cold and that his toes were blue. He found that he was unable to stand on his feet on account of pain and because "he could not feel his feet." On admission to hospital his only complaint was pain in his feet. Presented distinct icteric tinging of sclerotics; spleen palpable. Both feet showed discolouration of the toes, the left foot being more affected than the right. All the toes of both feet were affected, the colour varying from brownish-purple to purple. On the left foot the plantar surface of all the toes showed small bullæ; on the right foot only the large and third toes presented bullæ. The dorsalis pedis and the posterior tibial arteries of both feet could be readily felt pulsating. Patient was put on 1 drachm quin. sulph. daily and steadily improved. Both feet recovered without any loss of tissue.

Driver W., aged 21, admitted to hospital on Oct. 9th with diagnosis of malaria. Reported sick about ten days before admission to base hospital on account of shivering and pain in head and back. On second day of admission to a field ambulance the feet became very cold and continued so in spite of hot bottles. Next day the feet were seen to be blue. On admission to base hospital there was considerable œdema of both feet, all the toes of both feet were blue with large bullæ, especially on right big and second toes, extending for some distance over dorsum of feet. Several bullæ were burst and were discharging sero-purulent fluid. The dorsalis pedis and posterior tibial arteries could be felt beating quite strongly in both feet. Marked icteric tinging of sclerotics; spleen palpable one inch below left costal margin. Blood film showed no malarial parasites. Patient on admission was given an intravenous injection of 0·4 gm. galyl, and ten days later was put upon quinine. General condition rapidly improved, but considerable sloughing occurred over dorsum of large and second toes of right foot, involving loss of nail of great toe, and opening into first interphalangeal joint of second toe. Also slight superficial sloughing over dorsum of left large toe.

Mortality and Post-mortem Findings.

Thirty cases infected with malaria have died. Of these one was a case of subtertian malaria who was quite convalescent from malaria when he developed an extremely septic throat followed by pneumonia. Post mortem there was ulceration of the pharynx and epiglottis with septic consolidation of both lower lobes of the lungs. In two cases there was in addition to malaria a Shiga dysentery and the patients died of running dysentery. Post mortem, in both cases almost the entire mucous membrane of the whole of the lower bowel and the lowest two feet of the ileum was destroyed. One case died of amœbic dysentery and septicæmia. The mucous membrane of the lower bowel was much destroyed and there were abscesses in both kidneys. Four cases died of lobar pneumonia affecting one or more lobes. In one of those there was, in addition, an extensive hæmorrhagic pleural exudate. In those cases malaria was not the cause of death.

This leaves 22 cases with a total case mortality of 0 61 per cent. Three cases presented at the autopsy extensive lobular consolidation of the lungs, complicated in one by hæmorrhagic pleurisy. The immediate cause of death in those cases was also probably the lung condition, and it is a debatable question whether they respresent a double infection or a true complication of malaria. Two cases died of septicæmia. One was admitted to hospital with a septic arm following an intramuscular injection of quinine. At the autopsy pyæmic abscesses were found in the lungs and kidney and recent vegetation on the mitral valve. One was admitted in an extremely collapsed condition with numerous septic sores on both arms and developed signs of pleural and peritoneal effusion. At the autopsy there was found a right-sided septic pleural effusion and septic peritonitis. Streptococci were recovered from the pleural and peritoneal fluids.

Excluding those 5 cases, we have 17 cases of uncomplicated malaria with a mortality of 0·47 per cent. In one case the autopsy disclosed moderately advanced granular kidneys and in one case a right-sided hydronephrosis which had largely destroyed the right kidney.

We take this opportunity of thanking Colonel Purves Stewart, C.B., A.M.S., consulting physician to the Salonika Force, for his valuable assistance and advice, which was always at our disposal during this period. To Lieutenant-Colonel P. Mitchell we are also indebted for permission to use the hospital records, and to Captain R. Richards, R.A.M.C. T.F., for the hæmatological and bacteriological and post-mortem reports.

SHORTAGE OF MIDWIVES IN CORNWALL.—At the last meeting of the Cornwall Sanitary Committee the county medical officer of health (Dr. E. M. Clarke) reported that 20 additional midwives were required for the parishes of Cornwall. He stated that at present there was an excessive birth mortality in the county, 4·5 per 1000 births, compared with 4·0 per 1000 in England and Wales, and 2·0 per 1000 in some London districts, adding that the mortality rate depended upon the quality and amount of attendance available at birth. The committee decided to recommend the Cornwall County Council to make an additional grant of £275 for the training of nurse-midwives.

THE LATE MR. ALFRED UPTON.—The death occurred at his residence at Hove, on April 10th, of Mr. Alfred Upton, L.R.C.P. Lond., M.R.C.S., who had practised in Brighton and district since the year 1877. He came of an old North Sussex family, being a son of the late Mr. Henry Upton, of Petworth. Educated privately, he studied at St. Bartholomew's Hospital, London, where he was Foster prizeman and obtained distinction in surgery and forensic medicine. In 1875 he took the L.S.A. diploma and became M.R.C.S. in the following year. At Hove he had an extensive practice, and he will be greatly missed among the poorer classes, by whom he was regarded as a friend. Mr. Upton was a prominent Freemason, and was interested in sailing, cycling, and gardening. He leaves a widow and daughter.

NOTES ON THE SYMPTOMATOLOGY OF PARATYPHOID FEVER.

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THE following notes on the symptomatology of paratyphoid fever are based on the study of the case-sheets of patients admitted to an isolation hospital in France during the last five months of 1915 and observed by the writer and his colleagues. The diagnosis was confirmed, or rather established, by laboratory tests in all cases, the routine examination including one or more cultivations from the blood, three or more cultivations from the urine and fæces, and three agglutination tests. The large majority of the cases were infected by the *Bacillus paratyphosus B*; the incidence of typhoid and paratyphoid A being so small that these infections have not been included in the tables given below, which refer solely to 237 available records of paratyphoid B.

The main features to which attention will be directed are: (1) The type and symptoms of onset; (2) the type of pyrexia; (3) the condition of the spleen; (4) the eruption; (5) the appearance of the patient and the general course of the disease. These points do not, of course, by any means cover the whole ground, but may be found of some interest to those who desire to study the clinical details of the enteric group of infectious fevers.

1. *Type of onset.*—Three types have been noted:—

(*a*) The abrupt onset, which is by far the most frequent in this series, and includes two-thirds of the cases. The history of this type of case begins with an abrupt rise of temperature, accompanied by headache, shivering, and general malaise. Diarrhœa, usually lasting a few days, is common, and less so abdominal pain and vomiting. The initial diarrhœa occurs more frequently in cases in which the febrile attack is prolonged, and the same is true of vomiting. Thus in 56 cases in which the fever lasted for more than 14 days, initial diarrhœa occurred in 52 per cent. In 34 cases in which the fever lasted for 7 to 14 days it occurred in 30 per cent., while in 18 cases of under one week's fever the percentage was only 22.

(*b*) The second type of onset is still sudden, but is preceded by a variable prodromal period in which the patient is not well, but is generally able to perform his usual duties. This type was noted in 16 per cent. of the cases. The prodromal period varied in length, in one case it was given as 12 hours, and in others as two or three weeks, but usually it lasted for two or three days. The most usual symptom during this time was diarrhœa, which was noted in 36 per cent. of the cases; headache occurred in 20 per cent., anorexia in 12 per cent., backache and abdominal pain in 8 per cent. The abrupt exacerbation or true onset did not differ from that described above.

(*c*) The third type only occurred in 16 per cent. and was gradual and prolonged. It differed from the other two groups, as will be seen from the following figures:—

	Per cent.		Per cent.
Gradually increasing headache	83	Mild diarrhœa	42
Abdominal pain	50	General aching	33
		Vomiting	21

The point at which the patient gave up work was variable, and did not depend entirely on the severity of the symptoms, so that an actual day of onset was difficult to fix.

Some relationship appears to exist between these three types of onset and the duration of the fever, or, in other words, the severity of the intoxication. In the following table it will be seen that the abrupt onset, though most frequent in all cases, occurs in a higher proportion among the shorter attacks while the highest percentage of insidious onsets is found among cases of a more prolonged and severe character.

Duration of fever.	No. of cases.	Percentage with—		
		Sudden onset.	Prodromal symptoms.	Gradual onset.
Over 14 days	90	62·2	20·0	17·8
7 to 14 days	45	75·5	11·1	13·3
Under 7 days	22	81·7	9·1	9·1

Symptoms of onset.—The following table shows the frequency of the various *initial* symptoms and is based on the records of 157 cases. It is interesting to note that this table corresponds very closely with the figures published by Torrens and Whittington,[1] and Wiltshire.[2]

	Per cent.		Per cent.
Headache	84	Cough	13
Shivering	49	Vertigo	11
Diarrhœa	41	Constipation	7
Abdominal pain	32	Sore-throat	3
Backache	28	Epistaxis	2
Vomiting	25	Herpes labialis	1
General aching	24	Fainting	1

If the three tables are combined the following results are obtained:—

Headache	90%	out of 385 cases	
Diarrhœa	45%	,, 385 ,,	
Shivering	37%	,, 307 ,,	
Abdominal pain	32%	,, 385 ,,	
Backache	26%	,, 307 ,,	
General aching	25%	,, 385 ,,	
Vomiting	17%	,, 335 ,,	
Cough	13%	,, 307 ,,	
Epistaxis	10%	,, 307 ,,	
Vertigo	9%	,, 307 ,,	
Sore-throat	4%	,, 385 ,,	

2. *Type of pyrexia.*—The longer fevers naturally show a more characteristic type; thus in 97 cases in which the pyrexia was maintained for 10 days or more the following five types were distinguishable:—

(1) *Simple continued type.*—These constitute about 29 per cent. of the total and show no distinctive features except the common tendency to remission towards the end of the attack. (Chart A.) In the chart shown the course of the fever is remarkably regular, and shows the abrupt initial rise. In other cases in this group the temperature was more fluctuating and irregular.

CHART A (Type 1).

The chart gives in each case the morning and evening temperature, and the thicker lines indicate intervals of a week.

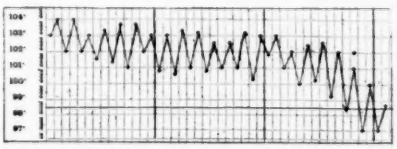
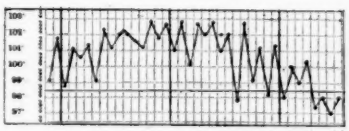


CHART B (Type 2).



(2) *Intermittent type.*—This group includes 43 per cent. of the series, and is to a certain extent characteristic of paratyphoid infections. The temperature in these cases, while remaining high in the evening, drops towards or below normal in the morning ("spiky chart"). The intermissions may be observed either at the beginning or end of the attack (Chart B), but are probably most frequent when the temperature is beginning to fall (Charts C and D).

CHART C (Type 2).

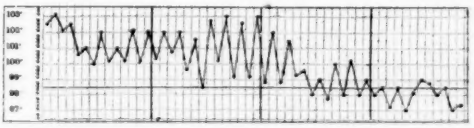
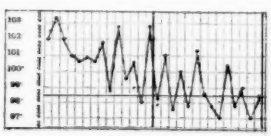


CHART D (Type 2).

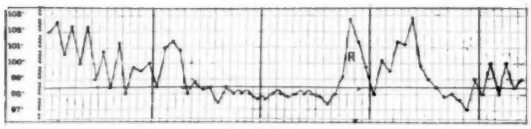


(3) *Undulant type.*—This small group constitutes 12 per cent. of the cases. No correlation was traced between this type of temperature and other features in the attack either as regards severity, the appearance of the rose spots, or the agglutination reaction of the serum. The mean duration of the fever was

[1] Brit. Med Jour., Nov. 13th, 1915.
[2] Practitioner, 1915.

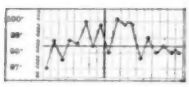
22 days, the longest period being 34 days and the shortest 14. In one case (Chart H) a relapse occurred showing the same

CHART H (Type 3).



R, relapse.

CHART H (*continuation.*)



type of temperature as did the original attack.

In two cases the rise of temperature constituting the ascending wave was definitely due to pleurisy and bronchitis, and in five others there were physical signs of bronchitis in the lungs, but no correspondence could be traced between the undulations in the temperature and the extent of the bronchial affection. In two cases not included in this group the temperature rose again after an apyrexial period of one or two days, which seems to connect the undulant type with attacks, followed by a definite relapse.

(4) *Low irregular fever.*—In 5 per cent. of the series the fever was a low, irregular type, the morning temperature being normal or subnormal and the evening temperature usually 99° or 100° F. This type may begin with a few days' high fever. The mean duration of the pyrexia in this group

CHART L (Type 4).

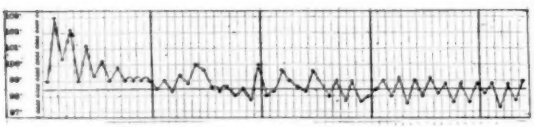
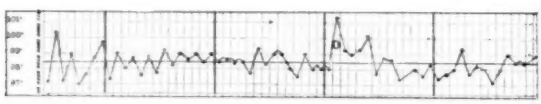


CHART L (*continuation*).

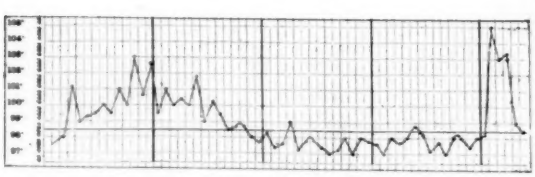


O, otitis media.

was 33 days, the longest period being 63 days and the shortest 15 days. The illness, though somewhat prolonged, is, as might be expected, of a mild nature. It is not associated with any special clinical or bacteriological characteristics (Chart L).

(5) *Type with subsequent rises of temperature.*—In this group, about 11 per cent. of the total cases, the initial fever may present the characteristics of any of the preceding types; the outstanding feature of the group being a sudden rise of temperature lasting from 24 to 48 hours, which occurs some days after the primary pyrexia is over and the general symptoms have subsided. These sudden rises may be repeated at intervals; they are usually accompanied by some headache and the general aching pains common in febrile states, but all the symptoms clear up as soon as the temperature becomes normal. In one case severe sweating and shivering were noted; in one case the spleen was enlarged,

CHART M (Type 5).



and in two there was tenderness over the left hypochondrium. In none of these cases was tenderness over the gall-bladder noted, though this occurs and has been held to point to a cholecystitis. In one case a blood culture made when the temperature was rising showed a negative result. In true relapse a positive culture can often be obtained from the blood when the temperature rises abruptly on the first or second day (Charts M and N).

CHART N (Type 5).

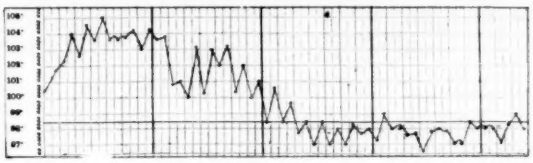
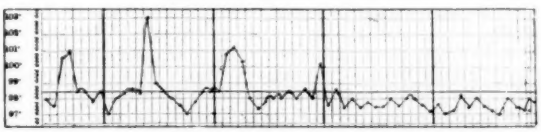


CHART N (*continuation*).



The following table shows the days on which the temperature rose in 11 cases, reckoned from the first day of normal temperature.

7th day	1 case.	5th and 12th day ...	1 case.
8th ,, ...	3 cases.	9th and 15th day ...	1 case.
16th ,, ...	1 case.	15th and 20th day ...	1 case.
17th ,, ...	1 case.	25th and 31st day ...	1 case.
4th and 9th day ...	1 case.		

In another series of 31 cases in which the fever lasted for 10 days or less the same phenomenon was observed in 4 cases. Two of subsequent rises of temperature occurred on the sixth day after the subsidence of the initial fever, one on the thirteenth day and one on the twenty-first day. In a fifth case, in which the initial fever was very short, the subsequent rises occurred on the fifth and fourteenth days. In this case the agglutinations were positive to paratyphoid B on two occasions in dilutions of 1:750 and 1:500 respectively, but no cultures were obtained. (Chart O.)

CHART O.

3. *Condition of the spleen.*—In the total series of cases the spleen could be palpated in 43 per cent.; increase of splenic dullness and tenderness in the splenic region were observed in others in which the organ itself was not felt.

In a few cases the spleen was palpable as early as the fourth day of disease, and in most it remained so till the end of the febrile period. Occasionally it did not return to its normal size for two or three days after the temperature had fallen. In these cases no relapse occurred. The organ is firm to the touch and the edge is usually easy to delimit; in six necropsies the actual weight varied from 3½ to 9 ounces, the average being 6½ ounces.

4. *The eruption.*—The characteristic eruption was observed in 63 per cent. of the total series.

The earliest appearance of the rash (one case) was on the third day and in some others it appeared for the first time on the fourth. In some cases crops of spots continued to come out till the beginning of the fifth week, and the last appearance of spots was in not a few cases subsequent to the final fall of temperature. The most marked feature of the rash was its pleomorphism, the following types occurring either singly or in association on the same patient:—

(i.) Small, well-defined spots, not much raised and of a darkish pink colour.

(ii.) Large, well-raised, light pink spots, with ill-defined, irregular margins.

(iii.) Fairly well-defined spots surrounded by a faint pink or purplish areola.

(iv.) Moderately sized, well-defined spots, conical in shape, with a tendency to become vesicular.

5. In the milder cases the appearance of the patient is not distinctive, but in cases of more severe type there is a peculiar bloated, flushed appearance which is to some extent characteristic. The patient is also somnolent or drowsy, but as a rule can answer questions accurately when roused. Although intensely toxic cases occur, in the great majority the patient does not appear so poisoned as the height and duration of the fever would lead one to expect. Convalescence is soon established, and if no sequelæ occur complete re-establishment of health is rapidly attained. A brief period of tachycardia is not, however, uncommon during convalescence. In three-fifths of the cases summarised the fever lasted for more than 14 days.

AN IMPROVED METHOD FOR THE ESTIMATION OF SUGAR IN THE URINE AND BLOOD.

BY P. J. CAMMIDGE, M.D. LOND.

IN the *Journal of Biological Chemistry* for November, 1915,[1] F. M. Scales described a new volumetric method for estimating reducing sugars, which he states gives as accurate results as those obtained by weighing, but with an expenditure of less than a quarter of the time.

A known volume of the saccharine solution is added to an excess of Fehling's solution and the mixture boiled for two minutes. It is then agitated to bring the precipitated cuprous oxide into suspension, immediately poured through a special funnel into dilute hydrochloric acid contained in a specially prepared volumetric flask, and made up to the mark with boiling water. After thorough mixing an aliquot part of the resulting cuprous chloride solution is pipetted into a known volume of dilute standard iodine solution and the iodine not reduced by the cuprous chloride titrated with a standard solution of thiosulphate, using dilute starch as the indicator. The difference between the number of cubic centimetres of thiosulphate solution oxidised by a blank control containing the same volume of iodine solution and the number of cubic centimetres of thiosulphate acted on by the iodine remaining after the addition of the cuprous chloride being proportional to the amount of cuprous oxide in the original solution, and this in its turn depending upon the strength of the saccharine solution, the percentage of sugar in the latter can be calculated by the use of appropriate tables and factors.

Shortly after the appearance of Scales's paper I carried out a number of experiments with solutions of various reducing sugars of different strengths, and was able to confirm his claims as to the accuracy and speed of the process. I therefore decided to adapt it to the estimation of sugar in the urine, as it did not involve the use of chemicals that are now difficult to obtain or are prohibitive in price, beside being simple and comparatively rapid. Experience suggested modifications in the technique to overcome minor difficulties which were encountered, and resulted in the evolution of a process that is, I think, an improvement on Scales's method. An account of the procedure I now employ may be useful to others, especially as, with slight modifications, it can be used for the estimation of sugar in the blood, cerebro-spinal fluid, &c., thus avoiding a multiplicity of apparatus and reagents, and giving results that are more strictly comparable.

In place of the Fehling solution employed by Scales I use a modified Benedict solution, made by dissolving 200 gm. of sodium citrate, 100 gm. of anhydrous (or 200 gm. of crystallised) sodium carbonate, and 10 gm. of sodium bicarbonate in about 600 c.c. of distilled water by the aid of heat, and adding to it, with constant stirring, a solution consisting of 21 gm. of crystallised copper sulphate dissolved in about 150 c.c. of distilled water. When the mixture has cooled to the room temperature it is made up to 1000 c.c. with distilled water and filtered. Preserved in a tightly stoppered bottle, this solution keeps indefinitely and may be used for qualitative as well as for quantitative work. It is about ten times as sensitive to the reducing action of sugar as Fehling's solution, so that a very small proportion of urine gives an unmistakable reaction even when it contains a very low percentage of sugar, and as it is not appreciably reduced by uric acid, creatinine, &c., the main difficulties encountered in using Fehling's solution are obviated.

Owing to the presence of sodium carbonate the addition of hydrochloric acid in the quantitative method causes an evolution of carbon dioxide, so that the subsequent operations are carried out in an atmosphere of that gas, thus preventing oxidation of the cuprous salts by the air—an improvement on Scales's process, where reliance is placed on the high temperature, speed of manipulation, &c. I find that the best results are obtained if 25 per cent. of a saturated solution of sodium carbonate (20 per cent.) is added to the copper reagent immediately before use. One of the drawbacks to Scales's original method is the way the reduced cuprous oxide tends to adhere to the walls of the beaker, especially after it has been used for several estimations, and if it is not of Jena glass. By adding the hydrochloric acid to the boiling copper solution this difficulty is overcome, and, as the atmosphere of steam in the beaker is replaced by inert carbon dioxide, the risk of oxidation is diminished. The cuprous chloride solution that results, still in its atmosphere of carbon dioxide, may be poured directly into the iodine solution through a suitable funnel without coming in contact with the air, at the same time avoiding the discomfort of measuring and pipetting the boiling hot liquid. The omission of the latter processes is also an economy of time.

Twentieth normal iodine solution is the most convenient to use. As the accuracy of the results depends largely on this solution, it must be very carefully prepared by dissolving 9 gm. of potassium iodide in about 200 c.c. of distilled water, then adding exactly 6·35 gm. of pure re-sublimed iodine and shaking occasionally until it is dissolved; finally, the solution is made up to 1000 c.c. with distilled water. A corresponding twentieth normal solution of sodium thiosulphate is made by dissolving about 13 gm. of the crystallised salt in about 500 c.c. of distilled water and making up to 1000 c.c. This solution is standardised against the iodine solution, preferably after standing over-night, using a 1 per cent. starch solution as the indicator and diluting as necessary according to the formula, $\frac{N \times d}{n} = C$, where N = the quantity of thiosulphate solution left to be diluted (in cubic centimetres), d = the difference between the actual and theoretical number of cubic centimetres of thiosulphate required in the trial, n = the number of cubic centimetres actually used, and C = the amount of distilled water (in centimetres) to be added to bring the solution to the standard strength.

The only special apparatus required in carrying out an estimation is a 200 c.c. conical flask fitted with a rubber stopper perforated with two holes, through one of which is passed the stem of a large-headed thistle-funnel, while the other is left open to act as a vent. The stem of the funnel is drawn out to a jet and is so arranged that the tip of the jet is just covered when the flask contains 100 c.c. of water.

Detection of Sugar in the Urine.

The modified Benedict solution is first used to determine the presence of a pathological excess of sugar in the urine and also to gain an approximate idea of the amount.

For this purpose about 5 c.c. of the solution are placed in a clean test-tube and eight drops, not more, of the urine added. The contents of the tube are then boiled, either in a free flame for one to two minutes, or, what I find much better, in a boiling water-bath for five minutes. In the latter case the water must be actively boiling when the test-tube is placed in the bath and it must be kept in a state of active ebullition for the whole of the five minutes. The advantages of this method are, first, the tendency of the boiling fluid to bump and spurt is avoided; second, there is no appreciable loss by evaporation, which may cause a misleading turbidity; third, a number of tests may be carried out simultaneously in a numbered rack, thus saving time.

When the heating is completed the test-tube is allowed to cool undisturbed at the room temperature for two minutes; if the urine is "sugar-free" the copper solution is clear, or only shows a faint blue turbidity due to precipitated urates, at the end of that time; should sugar be present, it becomes more or less opaque and changes colour, either before or after cooling, the bulk, colour, and rapidity of formation of the precipitate varying with the percentage of sugar. If there is only a small amount, under 0·1 per cent., or the reducing substance is chiefly pseudo-lævulose,[2] a light green opacity forms after the test-tube has been removed from the water bath; a more bulky green precipitate, present when the tube is taken out of the boiling water, indicates about 0·1 to 0·5 per cent., a dense yellow precipitate suggests about 0·5 to 2·0 per cent., and a thick red precipitate points to there being over 2·0 per cent. of sugar.

Estimation of Sugar in the Urine.

When a rough idea of the probable percentage of sugar has been gained a specimen of the urine is diluted with water according to the following scheme:—

A, light green precipitate, dilute	40 c.c.	to	100 c.c.
B a dense yellow	20		,,
C, a thick red	10		,,
D, occasionally*	5		,,

(* This dilution is only required if the urine contains over 6 per cent. of sugar, which is shown by a trial estimation with the previous dilution failing to give a satisfactory result.)

Exactly 5 c.c. of the diluted urine are now added to 15 c.c. of modified Benedict solution and 5 c.c. of a saturated solution of sodium carbonate, contained in a 200 c.c. beaker. The beaker is covered with a watch-glass, placed on a wire gauze over the flame of a Bunsen burner, and its contents heated to boiling. After exactly three minutes' boiling the watch-glass is removed and 10 c.c. of hydrochloric acid (sp. gr. 1·16) are cautiously run in, taking care to avoid excessive frothing. The contents of the beaker are now

[1] Jour. of Biol. Chem., 1915, xxiii., 81.

[2] Cammidge: THE LANCET, 1915, i., 320; 1916, i., 1216.

poured as rapidly as possible into the thistle-funnel of the flask described above, which has been previously prepared by placing in it about 100 c.c. of water and exactly 20 c.c. of twentieth normal iodine solution, measured with a pipette kept for the purpose. Care must be taken that the copper solution does not run into the flask too quickly and that it is thoroughly mixed with the iodine solution, as it does so by gently rotating the flask. The beaker is washed out with a few cubic centimetres of hot water and the washings poured into the funnel.

The flask is now unstoppered, the stem of the funnel washed into the iodine with a little water, and the standardised twentieth normal thiosulphate solution run into the latter from a burette until the brown colour of the iodine is almost discharged. At this point five or six drops of fresh, cold starch solution (about 1 per cent.) are introduced and the addition of the thiosulphate continued until the blue colour of the resulting iodo-starch is completely discharged. When the end-point is reached the solution has a faint light-green colour which it is quite easy to distinguish from the blue of the iodo-starch, even by artificial light. A control consisting of 100 c.c. of water and 20 c.c. of twentieth normal iodine, measured with the same pipette, is titrated with the sodium thiosulphate solution in a similar way. The difference between the number of cubic centimetres of thiosulphate used in the test and consumed by the control, multiplied by a factor varying with the dilution of the urine employed according to the following table, gives the percentage of sugar in the original urine:—

If a 40% dilution	(A)	was used, multiply by	... ...	0·0845
,, 20% ,,	(B)	,, ,,	(2 × 0·0845)	= 0·169
,, 10% ,,	(C)	,, ,,	(4 × 0·0845)	= 0·338
,, 5% ,,	(D)	,, ,,	(8 × 0·0845)	= 0·676

The total excretion for the day can then be worked out if the amount of urine passed is known. This is essential if reliable inferences are to be drawn, for although it seems obvious that a consideration of the percentage of sugar or any other substance alone is likely to be misleading, especially in a condition where the daily output of urine may vary considerably from the normal average, it is a fact that is frequently overlooked, as patients are often sent to me for consultation bringing an odd sample of urine, either not taken from a 24-hour collection, or, if it is, without any attempt having been made to estimate the quantity passed.

With the apparatus and solutions at hand an accurate determination of the percentage of sugar in a urine may be made by this method in ten minutes or less, and when a series of estimations is being carried out the time for each can be still further reduced. A control for every specimen is not necessary, but as the sodium thiosulphate solution gradually deteriorates on keeping, especially if it is not prepared with fresh distilled water and is not kept from contact with the air, it should be titrated against the standard iodine at frequent intervals. When it is used only occasionally it would probably be best to keep a stock solution of approximately double strength and dilute down as required, according to the results obtained with a trial titration against the standard iodine solution.

Estimation of Sugar in the Blood.

The same reagents and apparatus are employed as for the determination of sugar in the urine, but the iodine and thiosulphate solutions are diluted with distilled water, in a measuring flask, 1 in 50 (i.e., to thousandth normal), and it is an advantage to use a smaller beaker (50 c.c.) and a smaller flask (100 c.c.) and funnel for the iodine. As the dilute solutions do not keep well they should be prepared fresh as required.

For most cases of glycosuria and for normal persons 0·2 c.c. of blood is used, but when a very high blood sugar is expected (over 0·35 per cent.) only 0·1 c.c. should be taken. These quantities may be readily obtained from a prick with a needle, especially if the thin and comparatively insensitive skin at the root of the finger-nail is selected and the finger is congested by swinging the warm hand in a dependent position for a few moments and then constricting the finger with a narrow bandage or rubber tube. It is hardly necessary to point out that an accurately graduated pipette of narrow bore should be used for measuring the blood, and that any excess adhering to the outside must be carefully wiped off when the required quantity has been drawn up into the pipette. In order to remove the albumin from the blood and secure a solution suitable for sugar estimation, it is laked by mixing it with a known volume of deci-normal acetic acid (1 c.c. of glacial acetic acid to 125 c.c. of distilled water), made up to a definite volume with a saturated solution of sodium chloride, boiled, cooled, and filtered. An aliquot part of the clear filtrate is employed for the sugar estimation.

The details of the method are as follows:—

Exactly 3 c.c. of deci-normal acetic acid are placed in a clean test-tube and 0·2 (or 0·1) c.c. of blood is added, the pipette being washed out with the acetic acid two or three times by suction. The mixture is allowed to stand for at least five minutes and subsequently made up to 10 c.c. by adding exactly 6·8 c.c. (or 6·9 c.c. if 0·1 c.c. of blood was used) of clear saturated sodium chloride solution. The test-tube is now placed in a bath of boiling water for a minute or two, then cooled in running water, and its contents poured on to a small dry filter paper (5·5 cm. diameter). As the clot is apt to slide out of the tube suddenly and cause the solution to overflow the filter it should be broken up previously by tapping the tube against the finger. The first few drops of the filtrate are generally turbid and should be returned, as an absolutely clear filtrate is required.

When a sufficient amount has come through exactly 7·5 c.c. are measured with a pipette into a small beaker containing 1 c.c. of modified Benedict solution and 1 c.c. of saturated sodium carbonate solution. The beaker is covered with a watch-glass, placed on a wire-gauze over a Bunsen flame, and its contents gently boiled for exactly three minutes. The flame is then removed and 2 c.c. of pure hydrochloric acid (sp. gr. 1·16) are cautiously added. The solution is at once poured into a thistle-funnel-flask containing 25 c.c. of distilled water and 20 c.c. of thousandth normal iodine solution, the same precautions as to mixing, &c., being taken as in the urinary sugar determination. The beaker is washed out with 2 or 3 c.c. of hot distilled water and the washings poured into the funnel. The liquid adhering to the stem of the funnel having been washed into the flask with distilled water, the iodine is titrated with standardised thousandth normal sodium thiosulphate solution, using 3 drops of freshly prepared cold starch solution (about 1 per cent.) as the indicator when the brown colour of the iodine has been almost discharged. The end-point is shown by the disappearance of the last faint trace of blue, or purple, with a resulting colourless solution when the flask is examined against a dead-white background by diffused daylight; artificial light does not give satisfactory results. In warm weather it is advisable to cool the flask in running water before titration, as the last trace of blue is then more readily seen.

A control titration with 25 c.c. of distilled water and 20 c.c. of thousandth normal iodine is carried out for each blood or consecutive series of bloods, and the end-point carefully matched. The difference between the number of cubic centimetres of thousandth normal thiosulphate used for the test and for the control multiplied by 0·0203 (or 0·0406 if only 0·1 c.c. of blood was used) gives the percentage of sugar in the blood. The same method may be employed for determining the sugar content of cerebro-spinal fluid, &c.

These methods have been in daily use in my laboratory for over a year. I find that they are reliable, and are economical of time and material as compared with others previously employed. The modified Benedict solution, which keeps indefinitely unchanged, avoids most of the fallacies of Fehling's solution, and may be employed for both qualitative and quantitative work. The end-point of the urinary sugar determination is definite and easily recognised, even by artificial light, so that satisfactory results can be obtained with very little practice, and the whole process is so simple that it can be readily learned. The use of the same reagents and apparatus for the urine and blood is a considerable advantage from several points of view, and not least that comparable data are secured. As only a small amount of blood is required for each estimation several examinations of the same patient may be made on one day, if necessary, without discomfort. This is a matter of no small importance since the sugar content of the blood is now recognised to be of greater value in the diagnosis and treatment of diabetes than a determination of the output of sugar in the urine.

Nottingham-place, W.

DEATH OF MR. JOHN KING.—The death occurred at his residence at Stratton, Cornwall, on April 11th, of Mr. John King, L.R.C.P. Edin., M.R.C.S., L.S.A., J.P., in his 72nd year. He belonged to an old Cornish family who have practised in Stratton for many generations. He succeeded to his late father's practice nearly 50 years ago, and was for a long time medical officer of health for Stratton and Bude. It is mainly to his efforts that those towns have an efficient sewerage scheme, and he worked hard to secure the excellent water-supply which Bude now possesses. He was a justice of the peace for Cornwall.

Medical Societies.

ROYAL SOCIETY OF MEDICINE.

SECTION OF ANÆSTHETICS.

Anæsthetics at a Casualty Clearing Station.

A MEETING of this section was held on Feb. 2nd, Mr. GEORGE ROWELL, the President, being in the chair.

Captain GEOFFREY MARSHALL, R.A.M.C., read a paper on Anæsthetics at a Casualty Clearing Station. He showed that owing to the circumstances under which operations are performed at clearing stations the correct choice of anæsthetic often determines the patient's chance of recovery or the opposite. He discussed the choice as it affects the lightly wounded, those seriously wounded, and those suffering from serious sepsis. For the first class either gas and oxygen or an induction by warm ether and chloroform vapours was employed, warm ether being continued with. He showed that an investigation of the blood was an all-important step towards securing the right anæsthetic for those suffering severely from recent wounds. If there was a hæmoglobin percentage of less than 100, showing that the blood was dilute and that blood had been lost, then the use of stovaine by spinal injection was almost certain to be associated with serious fall of blood pressure and symptoms of collapse, and might lead to fatal results. The blood diminution did not produce the same effect if 40 hours or more had passed since the infliction of the injury. The conclusions as regards spinal analgesia were gathered mainly from consideration of 50 cases in which the hæmoglobin percentage, blood pressure, and pulse-rate were recorded before the injection of stovaine. Keeping the head low was found to be the most important step in preventing or combating collapse, and this position should be maintained for an hour after the return to bed. Intramuscular pituitrin was found of little use and intravenous saline gave only temporary help. Intravenous ether also did not give good results in the case of the shocked and recently wounded. Captain Marshall found gas and oxygen the most satisfactory anæsthetic for wounds of the limbs of extreme severity, and warm ether vapour for abdominal cases and for head cases. For chest cases and mixed chest and abdominal cases warm chloroform vapour with oxygen proved the most satisfactory agent; in the latter instances it was best preceded by injections of morphia, scopolamine and atropine. Collapsed patients received intravenous saline towards the close of the operation.

The paper was discussed by Colonel HUGH RIGBY, who had seen much of the work on which Captain Marshall's paper was founded; by Mr. TYRRELL GRAY, who disputed some of Captain Marshall's conclusions upon spinal analgesia and blood pressure; and by Mr. Z. MENNELL, Mr. H. E. G. BOYLE, and Mr. H. BELLAMY GARDNER.

ROYAL ACADEMY OF MEDICINE IN IRELAND.

SECTION OF MEDICINE.

Sudden Death in Tabes Dorsalis.—Limitations of Vaccine Treatment.

A MEETING of this section was held on March 30th, Dr. H. C. DRURY, the President, being in the chair.

Dr. A. R PARSONS read a paper on two cases of Sudden Death in Tabes Dorsalis. The first, a man aged 41, had consulted him two years before complaining of some difficulty in walking and unsteadiness, noticed chiefly while washing his face. There was also slight trouble in micturition—at first difficulty in passing; later, some loss of control. Seventeen years previously he had a sore on the glans penis, but no other symptoms. His wife had had one miscarriage. He was a healthy man with the exception of his nervous system, which showed typical, if rather slight, signs of locomotor ataxia. Wassermann reaction was faintly positive. The case ran the usual course for two years, when one day at dinner the patient, who during the day had been in his usual good general health, suddenly changed colour, and when examined was found to be dead. The second case was similar, death occurring suddenly during a game of bridge. In neither case could an autopsy be obtained, but frequent careful physical examination during life showed no evidence of arterial disease, and this could almost certainly be excluded. He considered the most probable explanation of death to be "cardiac crisis," a condition almost entirely overlooked in text-books, but mentioned by a few authors, notably Gowers and Osler —In the discussion which followed the PRESIDENT thought that, in the absence of previous anginal symptoms, it was questionable whether death could fairly be ascribed to cardiac crisis. In several cases of sudden death Professor P. T. O'Sullivan had, he said, found as the only recognisable lesion a sclerotic or atheromatous condition of the aorta about the openings of the coronary arteries.—Sir J. W. MOORE suggested that death was more probably due to brain mischief, e.g., cerebral hæmorrhage.—Dr. PARSONS, in reply, said that as far as was possible by clinical examination arterial disease had been excluded. Death was, he thought, too sudden in both cases to be explained by cerebral hæmorrhage.

Dr. R. J. ROWLETTE read a note on the Limitations of Vaccine Treatment. He spoke of the difficulty in general of judging of the value of a particular method of treatment, increased in the case of vaccines by the fact that treatment had been allowed to remain largely in the hands of men without clinical experience. In preventive treatment, the case for vaccines was now admitted, particularly in view of the experience of the present war. In curative treatment the efficiency of vaccines was limited by the power of reaction of the tissues. Moreover, while vaccines could stimulate the tissues to resist an active infective process, they had no power to restore integrity of the tissues after infection had ceased. Again, for vaccine treatment to be effective, accurate bacteriological diagnosis was a preliminary requisite. There was no incompatibility between vaccine treatment and the employment of other therapeutic methods, whether surgical or medical. Knowledge of the principles of immunity and of the practice of inoculation should in future be part of the instruction in therapeutics given in the medical curriculum.

Reviews and Notices of Books.

Organisation Physiologique du Travail. By JULES AMAR, Docteur ès Sciences, Directeur du Laboratoire des Recherches sur le Travail Professionnel au Conservatoire National des Arts et Métiers. With 134 illustrations. Paris: H. Dunod et E Pinat. Pp. 374. Price 18 fr.

THIS volume represents part of the work which M. Jules Amar has been carrying on at the Conservatoire National des Arts et Métiers at Paris since 1912, and for its full understanding requires to be read in conjunction with his book "Le Moteur Humain et les Bases Scientifiques du Travail Professionnel." M. Amar has been inspired by the work of Frederick Winslow Taylor, an American mechanical engineer, who from an artisan became a factory owner. By effecting improvements in the tools and methods employed by his workmen the output of his works was very considerably increased.

In his "Principles of the Scientific Organisation of Work" Taylor complains that the physiologist has not paid sufficient attention to "fatigue." M. Amar has now remedied this omission. The volume contains a description of the various methods he employs to investigate "fatigue." The phenomena of the contraction of muscles are recorded by a dynamograph; the muscular force is conducted by a spring which presses on an indiarubber ball connected by tubing with a Marey's tambour provided with a writing style which registers on a revolving cylinder the amplitude of the movements of the muscles. Dynamographs are fitted to various tools, including the file, plane, and shovel; the force, rate, and precision of the movements involved in their use can thus be registered. The energy expended is determined from the consumption of oxygen during respiration; to measure this he uses a eudiometric apparatus attached to a respirator fitted over the workman's mouth. Deductions are

made from cardiograms and pneumograms; curves are made of the variations of pressure of the expired air; the ratio of the duration of expiration and inspiration affords useful data. The ergometric (bi)cycle serves to measure the fatigue of the legs and arms; M. Amar's modification of the Mosso chirograph is used to investigate the fatigue of the muscles moving the fingers or wrist; the *poire dynamographique* (a hollow indiarubber ball fitted with air, the pressure of which can be varied), measures the grasping power of the hand; the arthrodynamometer measures the amplitude of movements of joints and the force of the muscles producing the movement.

In this book M. Amar does not go closely into the application of his principles to each of the various trades; he contents himself with urging that the use of his registering tools will indicate to the workman various faults which should be overcome. He emphasises the advantages of the correct position to assume when using a file; the cinematograph, he suggests, will indicate this position and help to eliminate any unnecessary actions during work. But the author gives a complete account of the adaptation of his methods for the functional and professional re-education of crippled soldiers; not only this, but he works out in a convincing manner the scientific principles of artificial limbs. By means of his dynamographic platform he analyses the movements of artificial legs, and is able to indicate the models which most nearly allow of the reproduction of the normal movements during walking. He gives a description of the various forms of artificial limbs he considers most useful both for the workshop and office. An account of his *pince universelle*, *anneau universelle*, and hook is included. He is an advocate for fitting elaborate mechanical hands even to men who have suffered an amputation at the shoulder, when the movements of the hand are produced by the expansion and retraction of the chest wall during breathing. A wide difference of opinion exists in France as to the value of such elaborate appliances. M. Amar's results lends support to those in favour of them. Possibly their provision is justified when limited to selected men of better education whose work is of a light nature and who are prepared and in a position to go to a certain amount of trouble to keep their appliances in order.

The book is written for the French general public. M. Amar has therefore included matters of interest primarily to Frenchmen as well as elementary physiological considerations. When dealing with general matters he is somewhat diffuse, but no such fault can be found when he gives us in book form the papers he has written on his own work. The book is the work of a pioneer and patriot, who is evidently gratified that the direction his life's work has taken has suddenly become of immediate value to the crippled defenders of his country.

JOURNALS AND MAGAZINES.

Journal of Physiology. Edited by J. N. LANGLEY, Sc.D., F.R.S. Vol. LI., Nos. 1 and 2. Cambridge University Press. 1917. Pp. 1–110. Price 8*s*.—On the Summation of Propagated Disturbances in the Claw of Astacus, and on the Double Neuro-Muscular System of the Adductor, by Keith Lucas. A melancholy interest attaches to this communication, for it is the last contribution to physiology made by that assiduous observer, Dr. Keith Lucas, who at the early age of 37 died on Oct. 5th, 1916, as the result of an aeroplane accident. There seem to be two separate neuro-muscular systems belonging to the adductor muscle—one for the slow movements of the claw and one concerned only with rapid closing. If the nerve to the adductor muscle is excited with a single stimulus the muscle may give either a small, slow contraction or a quick twitch according to the strength of the stimulus used. The excitable substance whose stimulation leads to the twitch has the shorter excitation time and needs the stronger current if the current duration is long. Richet described the summation phenomena in the claw of astacus, which belong to the type of "summation of propagated disturbances," in which the first stimulus, though apparently ineffective, does send an impulse down the nerve. The impulse fails to cause a contraction of the muscle, but ensures the success of a second impulse following it at a suitable interval of time.—The Excretion of Urea and Sugar by the Kidney, by Arthur R. Cushny. The commonly accepted view is that urea is a specific constituent of the urine and that a specific secretory activity is required for its excretion, which does not seem to be required in the same way by the inorganic salts. The physical properties of urea do not appear to justify its being treated as apart from the other constituents of the urine. The concentrations of sulphates in the blood and urine bear an almost equal ratio with those of the urea, and the same is true of the inorganic phosphates and creatinin. Even sugar, when it escapes by the kidney, may undergo a concentration of from 0·2 per cent. in the blood up to 10 per cent. or more in the urine, and thus nearly rivals urea in extent of change. The only sense in which urea can be accorded a special position in the urine is that it is normally present in large amount. Heidenhain drew an analogy between the excretion of sodium sulphindigotate and that of urea. His views, however, in regard to the passage of dyes through the kidney epithelium can hardly be maintained against the fact that dyes appear in the urine long before they occur in the interior of the cells, and that the maximum of staining of the epithelium takes place after the greatest concentration of the urine has passed off. Still, the view is widely held that the concentration of the urea takes place in the tube cells quite independently of the activity of the glomerular capsule The author repeated Heidenhain's experiments, substituting chemical estimation of the urea in the kidney, finding that: 1. When the spinal cord is severed no accumulation of urea occurs in the kidney, and, similarly, phloridzin ceases to cause accumulation of sugar. 2. Urea and sugar thus are not excreted in the way Heidenhain describes for the sulphindigotate of sodium, and all conclusions drawn from this analogy are erroneous. The site of secretion for urea and sugar therefore remains undetermined, and experiments on mammals offer no grounds for supposing that it differs from that of the other constituents of urine.—On the Localisation of the Calcium and Potassium Salts concerned in the Mediation of the Action of the Vagus Nerve on the Heart of the Frog, by W. Burridge. 1. Faradisation of the base of the frog's ventricle gives effects predominantly inhibitory when the heart contains blood and effects predominantly excitatory when the heart contains Ringer's solution. 2. After treatment of the perfused frog's heart with potassium salts the capacity to be inhibited from the vago-sympathetic trunk is lost and the capacity to be inhibited by the faradisation of the local nervous mechanism is regained. 3. The capacity to be inhibited from the vago-sympathetic trunk following treatment with potassium is restored by calcium. 4. It is suggested that calcium salts mediating the action of the vagus nerve on the frog's heart form an integral part of the structure, whatever it may be, on which nicotine acts. 5. The potassium salts concerned in vagus action are situated at the "nerve-endings" in the muscle.—Some Observations on the Action of Guanidine on Frog's Muscle, by John S. Meighan. Other observers have studied the effects of this base and its neutral salts. The spontaneous twitches it evokes in frog's muscles are less with higher than lower concentration of guanidine solutions. Its "curare," or paralysing, effect on nerve-endings in muscle seems to be due not to its action on muscle fibres, but either on the nerve-endings or on the "receptive substance" supposed by Langley to exist in proximity to the endings. A moderate rise of temperature (5° C.) increases its effect, but a great rise (25° C.) does not completely destroy it. The effect of cooling seems doubtful.—The Volume of the Dead Space in Breathing and the Mixing of Gases in the Lungs of Man, by A. Krogh and J. Hindhard. After a historical account of the measurements of the bronchial tree of a corpse (=140 c.c.) by Zuntz and Loewy in 1904, and the sampling of alveolar air by Haldane and Priestley's method (1905), and by other observers, the authors state that there is a clear and debatable issue between Haldane—who maintains that the dead space is a physiological and not an anatomical conception—and their own views. They hold that the air in the air-sacs (as well as in the atria) is not at the end of inspiration of the same composition throughout, because the air inspired is incompletely mixed with the air previously contained. The mixing takes place chiefly by diffusion, and requires a certain time. We must refer the reader to the original text for the methods used. The following are the authors' conclusions: 1. Just after inspiration the gas mixture in the lungs beyond the dead space (the alveoli taken in the widest sense of the term) is not uniform throughout. The differences are

usually slight, but with deep and slow breathing they become considerable. With deep and rapid breathing, as in muscular work, the mixing seems to be again improved. 2. In attempts to determine the dead space of the air passages these facts must be taken into account if reliable results are to be obtained. The very large dead spaces determined by Haldane and by Henderson and his collaborators are unreal. 3. The dead space of a human subject is constant at pulmonary inflations below the resting position of the chest. At larger inflations it increases gradually. With a maximum inflation of the lungs the increase may amount to 100 c.c. 4. No evidence has been obtained of any unequal ventilation of different lobes of the lungs. 5. The composition of the alveolar air should in most circumstances be determined preferably by calculation from the expired air, the volume of the expiration, and the dead space, When the breathing is deep the resulting increase in dead space should be taken into account, but during muscular work very slight errors only will usually result from not doing so, because the increase is small compared with the depth of respiration. The direct sampling, according to Haldane and Priestley, has in certain cases given rise to fallacious results. 6. Our method of examining the composition of the alveolar air by a series of consecutive samples from the same breath is open to objections. The errors are probably not large. 7. The errors caused by incomplete mixing of the pulmonary gases in our circulation-rate determination are much too small to be perceptible in experiments on normal lungs.—The Mechanism of Cardiac Acceleration by Warmth and by Adrenalin, by C. Lovatt Evans. Much work has already been done in this direction by using the heart-lung preparation of a mammal as devised by Starling. The factors which tend to diminish or increase metabolism and the efficiency of the heart are considered, analysed, and tested experimentally. It was found that: 1. The oxygen usage per beat, although approximately constant over small ranges of temperature in the neighbourhood of the normal body temperature, is increased at either extreme of temperature. 2. The cause of increased metabolism at abnormally low temperatures appears to be dilatation of the heart with increase of the active surface; other factors are operative in both increasing and in diminishing this effect, the resultant only being apparent. Similar considerations apply to the raised metabolism at high temperatures. 3. The effects of adrenalin cannot be traced to such purely mechanical factors; the increased metabolism is apparently due to a direct and specific effect in increasing and accelerating the chemical changes associated with contraction.—The Relations of Carbon Dioxide in the Blood, by George A. Buckmaster. Very conflicting views are held concerning the state in which carbon dioxide exists in blood. The statement of Pflüger in 1864 that a constituent of blood is capable of liberating carbon dioxide from the carbonates of that liquid is mentioned in most text-books on physiology. The author was led to doubt whether a carbonate could possibly be decomposed by hæmoglobin or any protein or amino-acid of the blood. If this view is found to be experimentally correct, then the total liberation of CO_2 from blood cannot be due to a protein. It was found that neither hæmoglobin nor, indeed, any other constituent of the defibrinated blood is capable of freeing CO_2 from sodium carbonate, and the same is equally true for solutions of the bicarbonate. The author attributes any CO_2 which is evolved as being dependent on the development of acidity in the blood.

Maternity and Child Welfare. Vol. I., No. 3. London: John Bale, Sons, and Danielsson, Limited, 83–91, Great Titchfield-street, W. 1. Price 6*d.* net.—The third number of this useful periodical contains interesting articles by Lady Barrett, M.D., on the Midwife and her Share in the Protection of Motherhood; by Dr. Amand Routh on the Ordinary Diseases of Women which may Affect Pregnancy; and by Mr. N. Bishop Harman on Ophthalmia Neonatorum. Shorter articles on Infant Welfare Centres, Food Values, and the Training of Health Visitors are also included, while the Annotations and Abstracts and Notes give summaries of some of the problems facing the medical and social worker among mothers and children and the attempts that are being made to solve them. The idea of publishing sectional maps of the British Isles showing the distribution of infant welfare centres, and the extent to which the work of each is developed and the amount of municipal help obtained, is a real inspiration. This magazine is "edited in the interests of the mother and young child by a member of the medical profession, with the help of an advisory committee representing the various groups of workers," and is an excellent example of a form of literature for which there is much need. The articles are written by experts from a scientific point of view, but in such language as to be perfectly intelligible to the voluntary worker (usually a layman) as well as to the nurse or health visitor.

The Child. Vol. VII., No. 6. March, 1917.—This number contains an important paper by Dr. M. F. Boulenger on the management of the exceptional child in Belgium. Before the war Dr. Boulenger was medical director of the farm-school for abnormal children at Waterloo (Belgium), and is now occupying a temporary post at the Darenth colony for defective children in Kent. Abnormal children in Belgium were until 25–30 years ago accommodated in the lunatic asylums, while the first special institutions were prison-like buildings, without classrooms or workshops, surrounded by treeless, macadamised airing-courts. In these wretched places children with faulty habits were tied all day on commode-chairs, lying at night on mattresses reeking of ammonia. All this was changed by the pioneer work of two physicians who had studied pedagogy previously to their medical graduation, Professor Jean Demoor and Professor Auguste Ley, who, between 1900 and 1906, were the means of founding centres for special education in Brussels and Antwerp, and later in Ghent, with after-care associations which arranged for the apprenticing of the boys and girls on leaving school. The Société protectrice de l'Enfance anormale, with the late Minister of Justice, M. Jules Lejeune, as its president, was successful in obtaining, by its active propaganda, special tribunals for juvenile delinquents. Dr. Boulenger himself put forward the idea of the farm-school in 1901 and pavilions were being erected on a large site in the province of Brabant when war broke out. Temporary courses for teachers had, however, already been given in the province in 1914. Dr. Boulenger generously acknowledges the influence of French and English ideas on his Belgian work: he was himself a frequent visitor at the special schools in this country and looks forward in confidence, with the resumption of Belgian national life after the war, to further rapid development in his own country of the care and training of abnormal children.

Reports and Analytical Records
FROM
THE LANCET LABORATORY.

THE WHITE WINES OF ANJOU AND TOURAINE (FRANCE).

(ALEXANDER WOOD, CAMPBELL, AND CO., 62, CRUTCHED FRIARS, LONDON, E.C.)

FOR medicinal or special dietetic purposes in which a light agreeable stimulant seemed desirable a preference has long been given to the German white wines of the hock and Moselle type (still and sparkling). They were chosen for their low alcoholic strength, their freedom from colouring matter, their small sugar content, and their low degree of acidity. But according to a recent examination we have made of some specimens, it is quite evident that certain of the French white wines answer these requirements equally well. The white wines, in fact, of Touraine and Anjou are in some respects better. They are light, elegant, and practically non-acid. We have received some 20 examples of these wines, a few of which we have submitted to analysis as giving a fair idea of their general composition and quality.

(1) *Touraine Supérieur* (still):—Alcohol by volume, 11·61 per cent.; extractive matters, 2·55 per cent.; mineral matter, 0·25 per cent.; sugar, 0·27 per cent.; volatile acidity reckoned as acetic acid, 0·12 per cent.; fixed acidity reckoned as tartaric acid, 0·82 per cent.

(2) *Anjou Supérieur* (still):—Alcohol by volume, 9·86 per cent.; extractive matters, 1·55 per cent.; mineral matter, 0·20 per cent.; sugar, 0·26 per cent.; volatile acidity reckoned as acetic acid, 0·09 per cent.; fixed acidity reckoned as tartaric acid, 0·86 per cent.

(3) *Vouvray tête* (still) :—Alcohol by volume, 12·05 per cent.; extractive matters, 2·40 per cent.; mineral matter, 0·20 per cent.; sugar, 0·45 per cent.; volatile acidity reckoned as acetic acid, 0·15 per cent.; fixed acidity reckoned as tartaric acid, 0·71 per cent.

(4) *Touraine Supérieur* (sparkling) :—Alcohol by volume, 8·18 per cent.; extractive matters, 5·35 per cent.; mineral matter, 0·15 per cent.; sugar, 3·33 per cent.; volatile acidity reckoned as acetic acid, 0·06 per cent.; fixed acidity reckoned as tartaric acid, 0·67 per cent.

(5) *Anjou Supérieur* (sparkling) :—Alcohol by volume, 12·05 per cent.; extractive matters, 5·54 per cent.; mineral matter, 0·14 per cent.; sugar, 4·16 per cent.; volatile acidity reckoned as acetic acid, 0·07 per cent.; fixed acidity reckoned as tartaric acid, 0·65 per cent.

(6) *Vouvray tête* (sparkling) :—Alcohol by volume, 13·43 per cent.; extractive matters, 4·49 per cent.; mineral matter, 0·19 per cent.; sugar, 2·50 per cent.; volatile acidity reckoned as acetic acid, 0·12 per cent.; fixed acidity reckoned as tartaric acid, 0·51 per cent.

These results bear out fully the claims that these French wines are, in regard to special dietetic requirements, not at all inferior to the German produce, and in certain respects they are superior. This, at all events, is the case in regard to a minimal amount of sugar, alcohol, and especially of volatile acid in the still wines, while the higher proportion of sugar in the sparkling wines is due to "liqueuring." These points may well deserve attention now that the supply of German white wines is cut off.

ANTIPHLOGISTINE.

(THE DENVER CHEMICAL MANUFACTURING CO., NEW YORK. LONDON AGENCY: ST. ANN'S-ROAD, BOW, LONDON, E.)

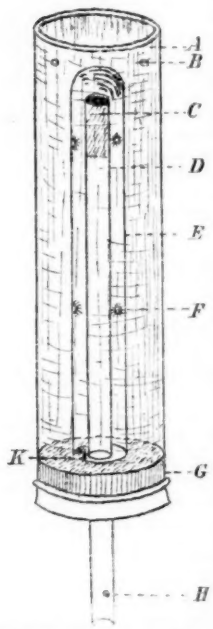
Antiphlogistine has been well described as a scientific mud which is externally applied hot and thick as a cataplasm for the relief of inflammatory and congested conditions. In connexion with its application for this purpose we have already referred to this preparation, which is composed of a finely refined earth compounded with glycerine, iodine compounds, boric and salicylic acids, and certain antiseptic essential oils. We are now informed that a poultice of hot antiphlogistine applied to the nose relieves the "stuffed-up" feeling so often characteristic of the common cold. In rhinitis and coryza favourable results are recorded. Applied over the nose in the case of a common cold at bed-time, the patient is said to secure relief of the distressing symptoms, a restful night, and a general feeling of well-being in the morning. The combined application in this way of heat along with antiseptic oils, and the like, may well produce an alleviation of such troubles.

New Inventions.

AN AUTOMATIC INTERMITTENT WOUND IRRIGATOR.

THE apparatus was originally intended for the intermittent irrigation of deep and infected wounds, and more especially of such wounds as are associated with compound fractures. In dealing with these wounds a mode of treatment associated with the name of Carrel has received general use and recognition. This treatment essentially consists in introducing into the crevices of the wound a number of rubber tubes each of about ¼ inch diameter; gauze packing is lightly introduced into the wound around the tubes. At regular intervals the tubes are irrigated through with a solution of eusol.

FIG. 1.



Syphon-action irrigator. Lieutenant Dunn's modification. *A*, outer glass tube; *B*, holes for suspending vessel; *C*, paraffined top of tube; *D*, inner glass tube; *E*, inverted test-tube; *F*, pinchings in test-tube to keep inner tube in position; *G*, rubber cork; *H*, air-valve; *K*, inlet in lower border of test-tube.

Hitherto the irrigation was secured by regular manual irrigation with a syringe. This method involved a considerable waste of time, much disturbance of the patient, and frequently the inducing of pain and irritation. This apparatus was produced with a view to overcoming these disadvantages, and its origin is largely owed to Corporal Studd, R.A.M.C. The apparatus embodies two simple mechanical principles: (1) The property possessed by two adjacent and connected fluids of finding a common level; (2) the principle of the simple syphon.

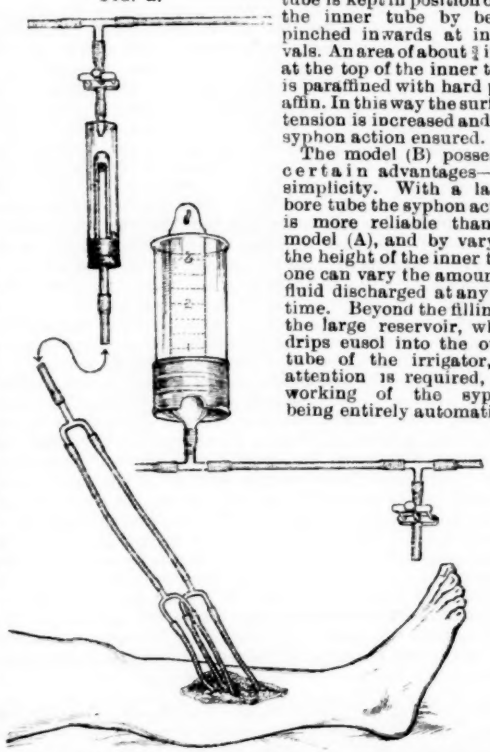
The original model (A) was composed of an outer glass tube and an inner bent tube. As the outer jacket filled with fluid, the fluid rose to a corresponding level in the open limb of the inner bent tube, and when the bend was reached the syphon action was commenced and the outer tube emptied of fluid. A simple air valve in the efferent limb of the bent inner tube obviates the occurrence of an air block.

The times at which the irrigation will occur can be regulated by varying the rate at which the drip feed of eusol from the reservoir flows into the outer tube. The interval will be the time which the fluid takes to reach the level of the bend. The efferent tube is connected up by Y branches with as many of the rubber tubes as are required for the irrigation of the wound.

Lieutenant Dunn, R.A.M.C., No. 3, Mobile Laboratory, has produced a modification of the original model, and has kindly given us permission to include the description of the modification. The apparatus is shown in Fig. 1.

A syphon is made by inverting a test-tube over a straight inner tube, and inlet is furnished at the open inverted end of the test-tube. The test-tube is kept in position over the inner tube by being pinched inwards at intervals. An area of about ¾ inch at the top of the inner tube is paraffined with hard paraffin. In this way the surface tension is increased and the syphon action ensured.

FIG. 2.



Showing the method of distribution of the fluid, from a central reservoir which may supply a number of irrigators.

The model (B) possesses certain advantages—its simplicity. With a large-bore tube the syphon action is more reliable than in model (A), and by varying the height of the inner tube one can vary the amount of fluid discharged at any one time. Beyond the filling of the large reservoir, which drips eusol into the outer tube of the irrigator, no attention is required, the working of the syphon being entirely automatic.

It should be added that the tubes leading from the syphon should be made as perpendicular as possible, and that the cross section of the distal tubes should not be more than that of the proximal ones.

An apparatus employed has been found easily adaptable to beds for the suspension and direction of the irrigator. The height, angle, or position of the irrigator can be variously altered.

J. FRASER, M.D., F.R.C.S.Edin.,
Captain, R.A.M.C.
S. D. STUDD, Corporal, R.A.M.C.

THE LANCET.

LONDON: SATURDAY, APRIL 21, 1917.

The Centralisation of Public Health.

THE Food Controller continues to issue recommendations with regard to limitation of our food consumption, implying that further drastic limitation is advisable or even, under the circumstances, necessary. Wheaten flour is his most serious concern at the moment, and every patriotic citizen is adjured to reduce his use of this staple article of diet, in whatever form, by 1 lb. per week. But there is no certain conviction in the public mind that these and other recommendations are consistent with the physical health of the community. No authoritative statement is issued, whether in fact they entail a reduction in mere eating which will be of advantage to the majority of us, or whether, under stress of necessity, we are to enter on a period of slight under-nourishment, with corresponding but inevitable loss of working efficiency. Medicine knows well enough that desire for food is not a fair guide to the individual as to his need for food intake, but the public should be told this and similar generalities by someone in authority. These and other kindred matters need, at the moment, intensive study by experts, who are in a position to make their pronouncements effective. Doubtless there is expert medical opinion at the disposal of the Food Controller's Department, but it is questionable whether the powers of that bureau are sufficient to give effect to the wide-sweeping recommendations necessary; in fact, here and immediately we come upon an urgent ground for the centralisation of public medical matters in a Ministry of Public Health.

The six State Departments which have at present duties to discharge in connexion with the people's health are the Home Office, the Local Government Board, the Board of Trade, the Board of Agriculture, the Board of Education, and the National Insurance Commission, to say nothing of Somerset House, which has charge of vital statistics, and the Food Controller's Department. Those familiar with the medical aspects of legislation in the making will remember how naturally it has come about that so many different State Departments are concerned. Assuming that our readers know the particular medical work for which the various Departments stand guardian, they will realise that if any one of these Departments is to take over the mass of the duties of the other five it will be either the Local Government Board, having the sanitary administration of the country under its control, or the National Insurance Commission, having for its charge the care in sickness of 14,000,000 subscribers, whose needs are administered to by a large proportion of the available medical men on the professional roll. If a new State Department be not especially created it will be necessary to reform or adapt one of these two for the conduct of enormously increased labours. Each has strong claims, the Local Government Board as the bureau of preventive medicine under the existing system, and the National Insurance Commission, already actively engaged in medical treatment and in the furthering of scientific progress through its Medical Research Bureau. There is between the two bodies but little overlapping or disputed territory of influence, so that a junction could take place without dislocation of public business; it could be of the loosest possible nature in the beginning and designed merely to obtain for the health of the nation one presiding force, and a centre around which later activities would be grouped.

Failing the creation of a new department, which we should prefer but which at the moment can hardly be looked for, we think that the cause of medicine, and therefore the welfare of the country, would be best served by constituting the Local Government Board the central authority for the health of the people. Its existing functions are closely connected alike with medicine and with the life of the people, so that any other health organisation acting independently from it would be in perpetual contact with it, and the delays and expenses following upon recurring discussions might largely counterbalance the advantages to be derived from the possession of a central authority. The Unionist Social Reform Committee, whose recent valuable pronouncement upon the health of the people we reviewed last week, arrived at a similar conclusion, and we add to the reasons for their faith, which are so excellently adduced in their report, a further one, for it may have real weight. The Local Government Board is heavily burdened with multifarious responsibilities towards the State, and there is sound reason for believing that once the central office for the health of the people, organised under its ægis, were grown vigorous under its far-reaching influence, separation would quietly occur, and a new Health Department would take in the public mind its proper position as one of the great Government bureaux. A separation of the Department of Health from the Local Government Board, which took place in this way, would have the advantage that to the separating body there would be naturally adherent, as a sequence of the past association, all those medical activities which cannot now by some movement of violent readjustment be torn from the Local Government Board and handed to the National Insurance Commission, or any other body; while the surrender to the new Department by the other Government Departments of the medical cares, thrust upon them through well-meaning legislation, designed to meet various wants as they made themselves felt acutely, would naturally follow. And of such a Department the National Insurance Commission, with the modifications in its working that are certain to occur in the course of time, would form one complete

side, linked by its Bureau of Medical Research to what is progressive in medical thought and to practical therapeutics by its responsibility for the medical treatment of a third of the population. With a great Department so constituted we need have no fear for the future of the general practitioner or for the health of the nation. No amount of centralisation or coördination can alter the fact that the individual sick person must be treated by the individual doctor, but the task will be carried out more efficiently as the care of the health of the people is better organised.

Bone Grafting.

WHILST bone grafting in the past has been rarely called for, and then chiefly to restore bones destroyed by osteomyelitis or new growths, the scope for its employment at the present day has been greatly widened by the injuries produced by gunshot wounds. It is, therefore, a matter of pressing importance to examine the facts underlying this procedure in order to estimate its possibilities and the best technique for securing success, and Mr. E. W. HEY GROVES, who has just received the Jacksonian prize for 1916, had good reason for taking this as his subject in the recent Arris and Gale Lectures delivered before the Royal College of Surgeons of England. It was, we believe, OLLIER who first demonstrated by experimental evidence the capacity of living osseous tissue for regeneration and the viability of whole and fragmented living bones when used as grafts. BARTH pointed out later that the rôle of even living bone grafts was largely passive, the graft itself possessing little osteogenetic power. AXHAUSEN, however, succeeded in showing that on all the free surfaces of a living graft, as also in some of its Haversian spaces, new bone was laid down, thus establishing the advantages of the living over the dead bone graft. MACEWEN carried further the principle of the viability of the bone cell, showing that this principle dominated the whole question of bone growth, the periosteum being a limiting membrane and the underlying osteoblasts the osteogenetic factor. It cannot, however, be said that the vexed question as to the functions of the periosteum has yet been finally settled. MACEWEN'S experiments, which have been confirmed by numerous observers, mostly in America, prove that it has no independent osteogenetic rôle, but there is considerable body of evidence to show that the structure is nevertheless of great value in the transplantation of bone. Probably under these conditions it acts as a vasoconductor and as a matrix for new bone cells.

From a practical point of view, it is generally admitted that living autogenetic bone, with its periosteum if possible, should be used for grafting, but there are many points of detail which have been submitted to experimental study by HEY GROVES. A graft may be fashioned as a peg and used as an intramedullary bolt. This is a very unsatisfactory method. If the graft is driven tight it remains indolent and inactive or breaks and allows the fractured bone to be displaced. If it is loosely placed it will only establish vital relations when the bed in which it lies remains undisturbed by movement. In other words, two conditions essential for rapid vital success in bone grafting—viz., firm fixation and rapid vascularisation of the graft—cannot both be secured in the intramedullary method, which is, moreover, mechanically weak. On the other hand, living grafts rapidly establish vital union with a living bone bed, if they are fixed on to the cortex of the bone, so that they can be firmly attached and at the same time quickly acquire a blood-supply from the soft tissues around. In order to appreciate the conditions desirable for successful replacement of bone tissue it is essential to recognise that though living grafts may be viable, yet this viability is of a very limited character. The osteoblasts on the surface of the graft do under favourable circumstances proliferate. They contribute to that very narrow zone of new tissue which eventually joins the graft to its bed, and at a later period they may take part in the general increase in thickness which the graft undergoes. But for the most part the bone graft, whatever may be its source, is a passive agent, differing from a metal plate chiefly in the fact that it finally becomes a part of the living tissues. It has little or no capacity for rapid bone formation. If, therefore, it is to replace a part of the skeleton which is lost it ought to be as large and strong as possible, and very firmly fixed in its place. If living bone used as a graft could be made rapidly to produce new bone—i.e., callus—then the matter would be quite different from what it is. Then we should select a porous, vascular, cellular bone like a rib, divide it up into splinters or chips, laying these in the vascular bed where bone is lost, and keeping the part at rest for the same length of time as is required for the repair of a fracture, with the expectation of finding at the end of this time a regenerated bone formed by new callus. But this is exactly what does not happen. A graft simply laid loosely in soft tissues remains for a time and then slowly becomes absorbed. A graft firmly connected with living bone grows to it, but not for many months does it show active osteogenesis. The more a bone graft is divided up into chips the less certain is its survival or its growth. Bone chips laid in a thin layer on a raw bone surface may quickly become the centre of callus formation, but the same chips filling a large bone gap simply remain indolent or become absorbed, because the majority of them have no direct contact with the only kind of tissue which can support them. Even MACEWEN, who is responsible for the idea of the osteogenetic value of small bone fragments, admits that he could not make bone dust grow, though he attributes this to the injury of the bone cells by heating. Unfortunately, however living bone dust is produced, it is found to retain such feeble capacity for bone reproduction as to be quite worthless. The ruling factors appear to be these: the union of a living bone with its bed is at first by means of a cellular granulation tissue which ossifies comparatively slowly. This union is always accompanied by a process of rarefaction of the adjacent

bone tissue, which whilst it lasts is a source of weakness. Therefore the first "taking" of the graft and its final incorporation with the skeleton will be greatly aided by the extent, the accuracy, and the firmness of contact between the old and the new tissues. If the part concerned is the spine or the skull, where little or no movement of the bone is possible, then correspondingly little suture is required. But if the graft is to fill a gap in a tibia, femur, or humerus, then mechanical fixation is a matter of the utmost importance. There has quite rightly been a reaction against the routine plating of fractures; but because metal plates and screws are only desirable as temporary suture agents there is no reason to ascribe to them an inhibitory influence on bone growth.

No doubt the most ideal bone grafting is that which, like the joiner's "dovetail" work, implies an exact fitting of one part into another so that no other fixation is necessary. But this is seldom possible in the repair of long bones. Fixation, then, should be by nails, screws, or wire, and, if the size of the bone will allow, by ivory pegs or bolts. The alternative to this is the use of animal ligatures only, supplemented by extensive plaster-of-Paris splinting. But this method is very insecure and uncertain in the case of the long bones, and the long immobilisation by plaster does everything to retard vascularisation and osteogenesis in the new tissues. The experimental comparison of dead and living bone-pegs, when these are used as nails driven into living bone, reveals the fact that they both behave in exactly the same way. The organic union between the peg and its bed seems to be as speedy and as firm in one case as in the other. There would appear, therefore, to be no object served by making bone nails for fixation purposes out of the patient's own tissues when ivory nails can be accurately prepared beforehand. In clinical practice all these principles are of the utmost importance. Grafts have to be carefully planned, fitted, and fixed if they are to give speedily successful results. Apart from the possibility of homoplastic grafting, which presents many practical difficulties, the best bone to use is the patient's own tibia, from the mesial surface or crest of which a long and strong graft can be prepared. It should considerably overlap the gap which it has to fill and be made to fit into slots in the ends of the bone to be repaired, and there fixed either by ivory bolts or nails or by wire.

But in the repair of gunshot wounds of bones, unfortunately, there are other elements which very gravely complicate the problem. These are latent sepsis, the injury of the soft parts, and the presence of large scars. For months after a wound has healed, especially that of a septic comminuted fracture, the tissues harbour the organisms of sepsis, which may flame into activity if the wound is reopened. To avoid this disaster a period of three to six months should be allowed to elapse before grafting, and by means of massage, active and passive congestion, the tissues may be either cleared of their infection or made to declare the presence of pyogenic agencies. In important cases it is, indeed, wise to do a preliminary operation for the clearing out of débris and the removal of scar-tissue, and to postpone the implantation of bone for another considerable interval unless this preliminary operation heals quite smoothly. Large superficial scars are a great source of danger. They will almost inevitably slough away after any plastic operation. Therefore either before or after any grafting operation such scars must be replaced by sound skin, and eventually the graft ought to be buried in muscle or fascia, so that it does not immediately underlie the skin wound. In its practical aspects bone grafting as applied to the treatment of gunshot wounds is so new and important that all surgeons engaged in this work should be urged to publish all their cases, bad and good alike, in order that a sound opinion and practice may result from their experience.

Professional Organisation among Medical Men.

WE are accustomed to hear from medical men that their profession is an unorganised body, and, therefore, at the mercy of the politician, who can always obtain his way from the whole by playing off some section against the others. We are equally familiar with the complaints made on political platforms, or even in the House of Commons, that the medical profession is such a perfectly organised ring that it can impose its will upon the legislature of the country. Of course, each statement is inaccurate, and when we say that a practical consensus of medical opinion has great weight, but that circumstances seldom elicit such a consensus, we have put the position in fairly correct terms. That this might well be so will, we think, be the opinion of our readers, when they study the section upon medical organisation, which will be published immediately in a supplement of the *New Statesman* dealing with professional associations. The authors of this section go very fully into a complicated story, and have succeeded in making it clear, though unfamiliarity with some of the details betrays them now and again into incorrect generalisations. The Medical Act of 1858, for instance, has never been transformed to include the ideals of the earlier medical reformers, for so far from creating one portal of entry to the profession, the number of portals have been steadily increased. A well-deserved compliment is paid to the energetic tactics of the British Medical Association, whose complicated machinery is carefully explained—so carefully that the analysis of the constitution will be useful, perhaps, to many of its members. The most interesting section is the one dealing with the relations of the doctor to the community, wherein the reasons dictating the professional attitude are well analysed and, we think, fairly handled, though in one or two places the particular difficulties of the medical man towards a public, which cannot be expected fully to appreciate the basis of his conduct or practice, are not brought out. We strongly recommend the whole article to our readers as forming a useful synopsis of their professional position, made from outside their ranks.

Annotations.

"Ne quid nimis."

THE PREVALENCE OF MEASLES.

MEASLES has interfered much with the amenities of civil and political life during the last few weeks, and there is a widespread impression that it has been more prevalent and more severe than in previous years. Within the compass of a single week 87 deaths from this disease have been recorded in London, 18 in Manchester, and 19 in Birmingham, while epidemics have been reported from most other large towns. School authorities have in many places been obliged to take action: infant schools in Dublin were closed early in March and several of the public schools in this country were obliged to take the same course. Measles presents indeed to the school medical officer a problem of much complexity which is likely to claim attention for some time. As was shown by Dr. J. H. Thursfield in the Local Government Reports for 1912–13, the serious pulmonary complications of measles are due to a mixed infection or one superadded to the primary infection. It is obvious that where large numbers of cases occur in an institution there is an increased opportunity for the individual case to find a secondary infection to which he is susceptible. Under these conditions a comparatively rare complication such as mastoid infection may become frequent in an institution where measles is prevalent and one such secondary infection present. To the school authorities it would be a great convenience if pupils arrived immunised against the disease in the only way at present known, that of having already had an attack. As 90 per cent. of the mortality from measles occurs in children under 5 years it is highly advisable to protect them from infection up to this age, although in the mortality from measles at any age it should be remembered that sanitary conditions play the leading rôle. In the year 1914 while the death-rate from measles per 1000 living for London as a whole was 0·31, that for Shoreditch was 1·02 and for Hampstead 0·02, or one-fiftieth of the mortality in the more crowded area. It has been estimated that in general the mortality from measles of children among the well-to-do classes is only one-fourth what it is in poor households. But whether children from the age of 5 to 10 years should be protected from sources of infection with the same care is a matter on which opinions may well differ. Unlike scarlatina, measles appears to be equally infectious at any period of life up to an advanced age. The chances of escaping exposure throughout life are remote, and the period of election might therefore, for many reasons, be the pre-school years. So acute has been the course of the disease amongst an entirely susceptible population, as in the classical examples of the Faröe and Fiji outbreaks, that some authors have assumed a degree of hereditary immunity among the general population handed on from parent to child. In harmony with this view is the admitted infrequency of measles in infants up to the age of 3 months, and a recent observation by Dr. Charles Herrman, of New York, that infants at a slightly greater age (3–5 months) contract the disease in such a mild form as to produce no effect on their weekly weight-chart. These characteristics of the epidemiology of measles demand further study, which should lead to an advance in our knowledge of the best methods of avoiding any considerable mortality. Prevention of the disease itself can, however, hardly be hoped for until the nature of the measles infection has been discovered.

BREAD ECONOMY.

AN exhortation to economy in bread is at the moment the Food Controller's message to the nation in regard to the food-supply. We are asked to reduce our bread ration and to forgo the use of wheat-stuffs at afternoon tea. It may naturally be asked how bread, which is commonly called the staff of life, can be replaced in the bodily economy. In considering this question we should remember the rôle of bread in the dietary, which is to supply the carbohydrate necessity in the daily intake. "Take care of the calories and the protein will take care of itself" is Professor Bayliss's adage, and it is clearly waste of time to discuss the value of bread apart from its carbohydrate content when substitutes of equal calorific value are available. Oatmeal, barley meal and flour, maize-meal and rice can be freely used without any apparent physiological disadvantage to replace or to eke out our supply of wheat flour. The view that wheat is an essential article of diet must therefore be regarded as ill-founded, a mere dietetic fetish. Other more available starchy foods should promptly come into general use, and the immediate desideratum is an earnest and practical study of the best and most palatable forms in which to present these substitutes on the table. If that were done by our cooks, bakers, and heads of families the idea of a physiological disaster might be put aside. The extreme importance of this simple temporary step should be universally realised, since its adoption may well mean the successful avoidance of great hardship, especially to the poorer parts of the community. The appeal to cut down the consumption of wheat flour should find a ready response from every patriotic individual in the land.

VOLUNTARY ACCELERATION OF THE HEART-RATE.

IT appears that there are a few individuals who possess the extraordinary capacity of voluntarily quickening the heart-rate; 13 instances in all have been recorded, and another is reported in some detail by Dr. John Favill (Chicago) and Dr. Paul Dudley White (Boston) in the current issue of *Heart* (vol. vi., No. 3, p. 175). The quickening commences almost immediately after the subject has willed it and one second after the word is given by the observer. The history of how such voluntary acceleration came to be acquired is interesting. There had never been any organic disease of the heart. At the age of 15 a quickened pulse-rate was noticed after mental excitement or physical exertion. Cross-country running about the age of 20 caused no cardiac symptoms even when seven miles were covered in 40 minutes. At the age of 22 the effort of climbing a small mountain sent the pulse-rate up to 190. Two years later the sensations which have since been found to accompany voluntary acceleration were induced for no known reasons and repeated occasionally in the following years. Two years after, in 1913, the power of voluntary acceleration was discovered by chance. It has been possible to exert this power ever since. Such quickening is dependent on a distinct effort of

will, and the strain is as tiring as that produced by holding up a heavy weight; it is not a succession of efforts but one that is continuous. Relief is felt with the cessation of the acceleration. During the quickening there is a feeling of fullness or tingling over the whole body. A mild exhilaration occurs for a few seconds, and moderate fatigue follows if the paroxysm is induced several times. The phenomena associated with the acceleration are as follows. The maximum increase in rate observed has been one of 96 beats, the rate changing from 104 to 200. An electrocardiographic record shows a quickening, on another occasion, of from 98 to 161. The least increase has been 30 beats. The maximum speed is reached after several beats have occurred; the high speed is maintained for a few seconds, then gradually descends to a normal rate. In the paroxysm the blood pressure is slightly raised, the pupils dilate, and some sweating occurs on the palms of the hands. The acceleration is suggested to be due, in great part at least, to the action of the accelerator mechanism and not chiefly to the withdrawal of vagal action, since acceleration can be induced even after atropine has been given, and since the character of the electrocardiographic curves during the quickening is similar to those which occur when the sympathetic nerves are experimentally stimulated. It is reported that this curious faculty has on two occasions been of service to its possessor. "Once in a condition of great fatigue in a hot operating-room, and again while watching cattle killed in a great packing plant for the first time, sensations of impending syncope were felt. On each occasion voluntary acceleration, with its rise of blood pressure, was induced and the feeling of faintness vanished at once." These observations are of interest as a contribution to the study of variations in the cardiac rhythm, and their publication may lead to the discovery of similar cases. The term "voluntary acceleration" remains in some sense a misnomer, unless conclusive evidence is present of a direct influence of the will upon the cardio-accelerator mechanism. In the case recorded the feeling of strain described suggests that some powerful voluntary contraction of muscles was involved to which the acceleration might have been a secondary or associated phenomenon.

SOME ESSENTIAL DIFFERENCES BETWEEN ANIMAL AND VEGETABLE FATS.

THE existence of accessory factors in various foods may be regarded as a well-established fact, and it is now becoming recognised that there is a considerable variety among these accessory foods. Experiment shows that young rats will not grow if fed on polished rice and butter, or on rice and wheat germ; while if both wheat germ and butter are added the diet becomes adequate. Milk contains both of these factors. There seem to be two groups of these substances; one is the "fat-soluble A" factor and the other contained in wheat germ is soluble in water, not in fat, and has been called the "water-soluble factor B." In a recent volume of the *American Journal of Physiology* (vol. xli., 1916) E. V. McCollum directs attention to the distribution in plants of the "fat soluble A," the dietary essential of butter fat. The question arises in view of the present consumption of margarine and other butter similars, whether any of the substitutes can actually replace butter in the diet. The question has been investigated in America by several observers and in this country by Halliburton and Drummond to ascertain whether the chief butter substitutes now upon the market contain the important fat-soluble A factor. Young growing rats were used, their dietary consisting of purified food-stuffs, such as caseinogen, starch, dextrin, sugar, the water-soluble B factor, together with the addition of the fat to be examined. A rat fed on such a diet with the addition of lard was eventually found to decline and die, but if the fat-soluble accessory substance A was added in sufficient amount and not too late, the life of the animal was saved and normal growth ensued. Some of the results may be summarised thus:—

"Oleo-oil" margarines.—In these the basal fat of low melting point "oleo-oil" is prepared commercially from beef fat. Osborne and Mendel in America showed that this commercial product contains the accessory factor associated with fats, and this form of margarine was found to be equal to butter fat in the nutrition of young rats. For vegetable oil margarines the basis is a cheap vegetable oil, e.g., coconut and peanut oil. Few, if any, of the chief vegetable oils—corn, olive, sunflower seeds, soy-bean, wheat, linseed, arachis, coconut, and cotton-seed oils—contain the fat-soluble A. Rats do not grow to adult size when any one of these oils is the only fat present in the dietary. Margarines made from these oils are deficient in the important fat-soluble factor.

Vegetarian suet and lard substitutes.—Those examined were free from the fat-soluble factor; one was a deodorised coconut oil and the other a hydrogenated cotton-seed oil preparation corresponding to "Crisco," sold extensively in the U.S.A. as a lard substitute, but is a useless substitute for butter.

The points raised are obviously of great practical importance and their solution essential to the proper understanding of some of the food problems which the war has forced upon our notice.

A CASE OF POST-OPERATIVE TETANY.

Dr. H. W. Stenvers records[1] a case of tetany occurring after the operative removal of the thyroid gland, or tetania parathyreopriva, as it is sometimes called, in which relief of the symptoms was obtained both by the administration of parathyroid gland tissue by the mouth and by the transplantation of parathyroid glands. The patient, a girl aged 20, had shown signs and symptoms of exophthalmic goitre four years previously, and had had the right half of the thyroid gland removed at that time. Eighteen months later a second operation became necessary, and the other half of the gland was taken away. While the patient was still on the operating table she had a violent and painful attack of tetany. Ever since that time she had been subject to attacks of tetany, which were worst just before the menstrual periods; latterly the tetany had been so severe as to prevent her from working. When she came under the care of Dr. Stenvers she was thrown into a state of forcible and painful tonic spasm, most marked on the right side, by any sudden mechanical, optical, or auditory stimulus. The physical signs of Chvostek, Erb, and Trousseau, characteristic of tetany, were all well shown by the patient, particularly on the right side. Dr. Stenvers draws attention to the rapidity with which tetany followed the removal of the last of the parathyroid glands in this patient. As a rule many hours or days elapse before tetanic spasms occur in these cases, and a quotation from Marine is given to show that in dogs tetania parathyreopriva may develop in as little as seven hours. Dr. Stenvers concludes that after

[1] Nederl. Tijdschr. v. Geneeskunde, Amsterdam, 1917, i., 85.

her first operation his patient was living in a borderland condition of latent tetany. Discussing the treatment of this form of tetany, he notes that the daily exhibition of a few decigrammes of fresh parathyroid tissue from the horse gave his patient great relief. This was shown in three ways: firstly, the muscles became much less excitable to the interrupted galvanic current; secondly, the excretion of creatinine in the urine was lessened; thirdly, the general condition of the patient improved. The importance of creatinine in tetany is this, that the tone of the voluntary muscles is much increased in conditions in which the excretion of creatinine is increased. Before the parathyroid treatment Dr. Stenvers's patient was excreting about 13 decigrammes of creatinine daily, but during the treatment this figure fell to about 6 decigrammes. Dr. Stenvers notes that horses' parathyroid glands are hard to come by during the war; his attempts to make use of the parathyroids of pigs failed, apparently because he was unable to find these organs in the animals. The next step in the treatment consisted in the implantation of three parathyroid glands by Professor Laméris, taken from patients with exophthalmic goitre. The results were excellent; four months later the patient was still able to work, though no longer quite free from the tetanic spasms, and the urinary creatinine had risen to nearly 9 decigrammes a day. Three months later the girl was still at work and delighted with the result of the treatment; the tetany was present still, but painless.

THE INVENTOR OF ESPERANTO.

Lazarus Ludwig Zamenhof, whose death is announced at Warsaw on Saturday last, was 57 years of age and a native of Bialystok in Russian Poland. Of delicate health, he was intellectually precocious, reading and writing well at the age of four. In 1873 Zamenhof's father having been appointed inspector of private schools at Warsaw, the boy finished his education there, going on to Moscow University to study medicine. After qualifying in 1885 he returned to Warsaw, where he specialised as an ophthalmic surgeon. Warsaw, with its mixed population of Russians, Poles, Germans, and Jews, early directed Zamenhof's attention to the need for a common language as an instrument of better civic and racial understanding, his idea being well expressed in the verse of the Esperantist hymn "La Espero":—

Sur neŭtrala lingva fundamento
Komprenante unu la alian,
La popoloj faros in konsento
Unu grandan rondon familian.

Zamenhof drew attention to a preliminary form of Esperanto in 1878, but it was not till 1887 that he published his first text-book. Warsaw did not greet its local prophet with enthusiasm, and it was only after obstinate opposition that his propaganda spread through to Poland, Russia, Germany, Sweden, France, and finally in 1902, to England. In 1905 the first Esperanto Congress was held at Boulogne-sur-Mer and since then large gatherings have collected annually at Cambridge, Dresden, Barcelona, Washington, Antwerp, and Cracow, at which all the nations of the world have been represented. Medicine and pharmacy are now represented by the *Tutmonda Esperantista Kuracista Asocio* and the *Internacia Esperantista Farmaciista Asocio* respectively, and a medical periodical, *La Kuracisto*, only ceased to appear on the outbreak of war. Zamenhof therefore lived to see a large measure of recognition given to his ideal of the drawing together of the races by means of a language which could be commonly used in addition to their native tongues.

HYDROCARBONS IN FISH LIVER OIL.

THE discovery of a high proportion of hydrocarbon in fish liver oil is remarkable, and should set chemists and physiologists thinking as to how its presence is to be explained in place of the usual saponifiable fat or glyceride. Mr. A. Chaston Chapman reported at a recent meeting of the Society of Public Analysts that a sample of oil from certain species of sharks caught off the coast of Morocco had been found to contain as much as 90 per cent. of unsaponifiable matter, consisting almost entirely of a new unsaturated hydrocarbon to which the name of spinacene has been given and the formula $C_{30}H_{50}$ assigned. Apparently there are two main classes of shark-liver oils, the one having a specific gravity of about 0·86 and containing a very high percentage—up to 90 per cent. —of unsaponifiable matters, and the other having a specific gravity of 0·91 to 0·93 and consisting largely of glycerides with smaller proportions of unsaponifiable matters containing cholesterol. As Mr. Chapman points out, the fact that these two classes of oils have totally different chemical characters and could not therefore be used for the same purposes makes it desirable to qualify the simple designation "shark-liver oil" by a statement of analysis. In soapmaking, of course, an oil containing so much hydrocarbon would be practically useless. Should such oil find its way into cod-liver oil the therapeutic intentions of the prescriber may well be set at naught, hydrocarbons, as is well known, possessing no nutritive value.

THE next session of the General Medical Council will commence at 2 P.M. on Tuesday, May 22nd, when Sir Donald MacAlister, the President, will give an address.

Sir Ernest Goodhart and Mr. Gordon Goodhart have given the sum of £300 to Epsom College in memory of their father, Sir James Frederic Goodhart, who was one of the earliest pupils at the College.

ROYAL COLLEGE OF SURGEONS OF ENGLAND.—A quarterly meeting of the Council was held on April 12th, Sir Watson Cheyne, the President, being in the chair. In accordance with the recommendation of the Jacksonian Committee the Jacksonian prize for the year 1916 was awarded to the author of the dissertation bearing the motto "Experientia docet"; when the envelope bearing this motto was opened, the President announced the name of Mr. Ernest W. Hey Groves. The subject of the dissertation was "Methods and Results of Transplantation of Bone in the Repair of Defects caused by Injury or Disease." It was resolved that the subject for the Jacksonian prize for the year 1918 should be "The Injuries and Diseases of the Pancreas and their Surgical Treatment." Sir Arthur Thomas Sloggett, K.C.B., C.M.G., was elected a Fellow of the College under the section of the charter relating to Members of 20 years' standing. Mr. Charters J. Symonds was appointed a representative of the College on the Senate of the University of London for a period of four years in the vacancy occasioned by the expiration of the period of office of Sir Rickman J. Godlee. The President reported that, together with the President of the Royal College of Physicians of London, he had received a deputation from the National Medical Union on the subject of the mobilisation of the medical profession.

TUBERCULOSIS IN AUSTRALIA.

THE report on tuberculosis which has just been issued by the committee appointed to consider and report on the causes of death and invalidity in the Commonwealth of Australia [1] is to be welcomed as a distinct contribution to the knowledge of the subject. The personnel of the committtee, over which Mr. James Matthews, an Australian Member of Parliament, presided, adds material weight to the character of their conclusions. Sir H. B. Allen's pathological and general knowledge is supplemented by Dr. J. H. L. Cumpston's special information, for he had previously acted as a Royal Commissioner when principal medical officer of Western Australia, and then made a most valuable report on the incidence of miner's phthisis. Dr. A. Jeffreys Wood, the fourth member of the committee, has particular experience of children, and thus rounds off the equipment of a well-chosen body.

Factors concerned in the Control of the Disease.

The report displays many points of especial interest in the light of the peculiarly favourable climatic conditions for chest diseases existing over the greater part of the Commonwealth, and the superior conditions of living among the general mass of people. The problem divides itself, there, as here, into two questions. To quote the report:—

> The whole study of tubercle must be of a twofold character—firstly in relation to exposure to infection with the bacillus, and secondly in relation to the resistance of the individual.

The second problem, which time is showing to be the more important of the two, has hardly received the consideration its importance deserves. The report states:—

> The two principal factors concerned in the determination of the results of infection are: (1) Personal resistance of the individual infected; and (2) effect of environment on the health of the person. With regard to the comparative importance of either of these two factors very little can be said in the present state of scientific knowledge, yet it is becoming increasingly evident that they are the main factors concerned in the cure and control of the disease.

The principal attention of the report is directed to the infectious side, although the evidence brought together does not suggest that the following up of that side so exclusively has yielded results commensurate with the expenditure.

In England and Wales, at any rate, the fall of the death-rate has not been materially altered by the knowledge that the disease was infectious, which was established in 1884 with Koch's discoveries, although in Australia there has been a more definite improvement since that discovery. This especially holds in Queensland, where the top year of a rising death-rate was 1884 with 196 per 100,000, as against 183 in England and Wales, whereas Queensland's death-rate in 1914 had fallen to 42, while England and Wales still stood at 101, more than double.

In this connexion it is interesting to contrast the position of the question in the old country, with its death-rate uniformly falling during the whole of the last century, with the various Australian States, which reached their top on a rising death-rate for pulmonary tuberculosis in the following years:—

New South Wales	(1885) 116	..... (1914)	64
Victoria	(1887) 153	..... ,,	72
Queensland	(1884) 196	..... ,,	43
South Australia	(1888) 118	..... ,,	64
Tasmania	(1887) 115	..... ,,	45

In England the rate has uniformly fallen:—

In 1870 ... 241	In 1884 ... 183	In 1904 ... 124
,, 1874 ... 209	,, 1894 ... 138	,, 1914 ... 101

Making a comparison between the rate before 1884, we find Koch's discovery year and subsequent years:—

	1875	1885	1895	1914		1875	1885	1895	1914
England	220	177	139	101	Queensland ...	141	192	96	43
New South Wales	105	116	81	64	South Australia	100	99	96	64
Victoria	130	145	132	72	Tasmania	—	111	75	45

These figures suggest a somewhat generally held view among medical men in Australia that infection is possibly a matter of more importance in countries with higher average temperatures, which means that education concerning and precautions against infection are more valuable in countries belonging to the warmer latitudes.

[1] F. 11968. A. J. Mullett, Government Printer, State of Victoria.

Notification.—Death-rate in Relation to Age.—Distribution.

As regards notification, the question does not seem to be in a much more satisfactory condition in Australia than in this country, as the notification proportions to death-rate show that the average case is not notified till the later stage of the disease. In this connexion a great improvement will occur when the death-rate figures are published in definite periods, after notification has occurred, say, one month, six months, 12 months, 18 months, and so on, then a reasonable comparison of results can be instituted between the various States. It will probably be found that by far the greater number of deaths occur within six months of notification, suggesting that the present practice is to notify long after the infectious state has been reached, which in itself would more than nullify the procedure.

In relation to the age at which tubercle is most dangerous, a most interesting set of figures is given which demonstrates that the death-rate from tubercle does not in males differ very much in accordance with age, rising slowly from 111 per 100,000 between 25 and 29 till it reaches its maximum in males between 55 and 59, or 185 per 100,000, then slowly falling to 137 between 70 and 74. In women the incidence is quite different. The corresponding figures rapidly rise from 113 per 100,000 between the ages of 20 to 24, to a maximum of 135 per 100,000 between 25 and 29, and as rapidly fall to 121 between 30 and 34, gradually diminish to 91 per 100,000 between 60 and 69.

The rate is never so high for women as men after the thirtieth year. The high figures for women in early life are probably due to child-bearing and the sexual periods which have such an injurious relation to tuberculous women, and in this connexion it must be remembered that the healthy woman marrying the tuberculous man finds far greater danger of infection than if the risk were the other way about.

The distribution of tuberculosis in Australia is a matter that must attract considerable attention. The figures are for the year 1911 and for men only (the total number of deaths analysed being a little over 2000), but they yield first of all the statement that tubercle is most fatal among those of independent means, being at the rate of 222 per 100,000, independence being apparently even more fatal than mining and quarrying with its 200 per 100,000, industrial 153, professional and commercial 120, winding up with pastoral and other primary industries at 25 per 100,000. This suggests some reflections, and accords with the view held by many that resistance to tubercle is less among the well-to-do classes, and manifestly it can in their cases be neither housing nor want, but the disease catching them at their best, with no reserve, and with little grit, so to speak, putting the balance on the side of the bacillus. This return is very interesting from a treatment point of view, and suggests that the rich suffer from insufficient stamina, and that an increase of hardening should be aimed at for their successful treatment. The pastoral industry, on the other hand, probably working longer hours at a slower pace than any other, gives the best results.

Preventive Measures.

Years ago the prevalence of tubercle in the colony was supposed to be due to importation of cases attracted by the suitable climate, but statistics put an end to that fallacy, as it is found that 72 per cent. of the deaths occur amongst those born in the colony, and 13·5 with over 20 years residence, while only 6·2 occurred within five years of arriving. In a democratic community like Australia it is interesting to see that the treating of tuberculosis as a penal offence is suggested. That is all the more striking, as the view which regards infection as being the main cause of the death-rate has had little fresh evidence brought forward in its favour. Although gross infection undoubtedly does act injuriously, only in about 30 per cent. of the cases is any contact proved, which is an insufficient number to justify the drastic powers suggested. It must be remembered that Sir H. Allen's experience in the post-mortem room of the Melbourne Hospital confirmed the now generally admitted fact of the almost universal tuberculous infection in later life, as first practically demonstrated by Naegeli and von Pirquet. If this is so, the line of success must lie in seeking to increase the resistance rather than in the diminution of infection. It must be remembered that smaller incidence in women, especially at the later period when men are most subject, almost proves

this contention. The men and women graph at the end of the report is a most eloquent statement. The lowest women's death age is from 50 to 55, and the highest death age for a man is 55 to 59, women then being under 80 per 100,000 and men over 180 per 100,000, an impossible position if infection were the main cause of death-rate.

It should, we think, be remembered that penal clauses militate against their own success as tending to prevent the notification of earlier cases. The State should, in its own interest, be prepared to provide beds for all later cases desiring them. There should be no such position as "hospital beds full, no room for more." Likewise every effort should be made to remove notably infectious cases, on ordinary sanitary grounds, from lodging-houses and places of public resort. But interference with the home must be very carefully safeguarded except by the legitimate means of education and persuasion, save in those cases where poverty and dirt render some alteration necessary in the interests of the individuals themselves as well as the community.

Far more important in our view is the question of proper sustenance for the dependents of the tuberculous, a point at present more responsible for the extension of the disease than any other cause, by diminishing the resistance, from insufficient food, to those already probably considerably infected. Here comes in the question of the extreme value of the invalidity pension of the Commonwealth, which might well be copied in this country. It appears fair that the community should see that those to whom it supplies pensions should take proper precautions, and the pensions investigation suggested in the report has all in its favour. By investigating the condition of the pensioners many important problems could be settled to the material welfare of the community. How important these pensioners are to the Commonwealth finances is indicated by the payment made under the Act of £44,000 in the last five years. We are glad to see that the report suggests that the pensions should not be interfered with on the patients entering hospital.

Administrative measures, the report says, should be adapted to the knowledge and experience already available. The latter are, as we have seen, by no means the same in Australia as in this country, but there, as here, the keynote of success probably lies in the dispensary system, which keeps in touch with the tuberculous in their own homes. "Considerable extension," the report's recommendation runs, "of the dispensary system is required, with the object especially of detecting the early cases before they reach the stage when they are infectious for others. A necessary corollary to this is the provision of sufficient sanatorium and hospital accommodation to afford a bed for every early case." The object of this provision being contained in the statement, which we can cordially endorse: "They go to the sanatoria for cure and for education, and cure rests mainly upon education."

Another useful suggestion in the report is to the effect that the school medical inspectors be supplied with a definite standard of nutrition in school children for them to work upon. Undoubtedly the undersized and undeveloped are the most susceptible to tuberculous diseases in youth. We think it probable, however, that a different standard would be required for each colony and possibly for different degrees of latitude in each colony. The suggested observation of nutritional percentages[2] at regular periods by the teachers would probably bring early tubercle more under observation than any other single simple measure. The effect of different latitudes on the development of a similar race in regard to tuberculosis would, in addition, yield material of enormous importance to the problem of the white development in Australia, a matter more nearly touching national life in the Commonwealth than in any other part of the British dominions.

In conclusion, a word of commendation must be given for the excellent graphs which accompany the report, the high character and able presentment of which reflect the careful selection of the Commissioners.

[2] THE LANCET, 1915, i., 85.

THE LATE CHARLES MOON, M.D. EDIN.—Dr. Charles Moon, whose death has just occurred at his residence, Dundee, was born in 1843, and educated at St. Andrews and Edinburgh Universities. After qualifying, he started practice in Dundee, where he built up a large practice over a period of half a century. He is survived by a widow, five sons, and two daughters.

THE CONTROL OF VENEREAL DISEASES.

The Bootle Scheme.

THE scheme for the diagnosis and treatment of venereal diseases adopted by the Bootle town council has been approved by the Local Government Board and is now, we learn from Dr. W. Allen Daley, medical officer of health, in operation. The salient features of this scheme are as follows:—

1. Cases of venereal disease in their earlier and all communicable stages will be dealt with at the treatment centre (borough hospital), irrespective of their place of residence or their means. 2. Mr. W. N. Clemmey, M.R.C.S., honorary surgeon and radiologist to the hospital, has been appointed medical officer to the clinic, to be held at noon on two days a week, with facilities for attendance in the evening of persons unable to attend during working hours. 3. Provision has been made at the hospital for microscopical examination of specimens from gonorrhœal cases. Examination for spirochætes and Wassermann reactions will be undertaken by Professor L. M. Beattie at the University of Liverpool. 4. Private practitioners may send patients to the hospital for blood to be taken for Wassermann reactions or for smears for the examination of spirochætes to be prepared. 5. A report is posted to any private practitioner who sends a case for consultation. 6. The Borough Hospital Committee receives £100 per annum for the services of its medical officer, and £25 for therapeutic agents for a period of six months. Approved substitutes for salvarsan to be supplied by the Corporation. The Hospital Committee reserves two beds to be used exclusively for persons suffering from venereal diseases, the council paying £200 per annum, and an additional sum of 5*s*. per night is paid for each person admitted for intravenous injection when the two reserved beds are already occupied. 7. On personal request from private practitioners, reports on the previous treatment of patients will be furnished, but such reports will be given only with the consent of the patients. 8. The scheme does not include the treatment of patients in places other than the hospital. If the medical officer is called upon to attend patients in their homes a special fee will be charged.

The cost of these arrangements for the first 12 months is estimated at £400, including the provision of a third bed in the hospital on 200 nights. The medical officer of health is a member of the Liverpool Branch of the National Society for Combating Venereal Diseases and under its auspices lectures are being given for public instruction and enlightenment.

Antimonial Treatment of Phagedæna and Syphilis.

A paper by Dr. D. José Brotons, in the *Revista de Medicina*, on the treatment of phagedæna and syphilis by the intravenous injection of antimonial compounds (Los compuestos antimoniales por via endovenosa en el tratamiento del fagedenismo chancroso y en la sifilis) is of considerable interest. The author gives clinical histories of five cases treated by this method, three of soft chancres with phagedæna, one of ulcerating gummata, and one of hard chancre with very severe secondary symptoms and rapidly deepening cachexia. In all these cases rapid improvement leading to cure of the condition was brought about by intravenous injections of doses of tartar emetic varying from 3 to 10 centigrammes, and this after other methods of treatment had failed to arrest the morbid process. Dr. Brotons claims for antimony specific "anti-spirillary" properties, and dissents from McDonagh's view that it acts merely by heightening the effect of iodine.

Post-Graduate Summer Courses in London.

Three hundred panel practitioners have already attended the courses of instruction given by Lieutenant-Colonel L. W. Harrison at the Military Hospital, Rochester-row, London, S.W. 1, and arrangements are being made for holding further courses of instruction at the hospital during the forthcoming summer. Many practitioners were compelled to forgo attendance at the winter courses through pressure of work. The summer courses will be extended over a period of six weeks in order to give more opportunities for practical work. Lieutenant-Colonel Harrison is prepared to give those practitioners who have already attended at the hospital a larger opportunity of attending practical demonstrations. Applications should be made to the secretary of the London Panel Committee, 51, Chancery-lane, W.C. 2.

PARIS.

(FROM OUR OWN CORRESPONDENT.)

The Results of Operation in Purulent Arthritis.

M. Auvray has recently summarised at the Society of Surgery the operations performed by him during the war in 111 cases of suppurative arthritis of the large joints. In every case definite purulent arthritis was shown to be present, sometimes unrecognised for several weeks after the infliction of the wound. Only the immediate results of operation were available in regard to life and the preservation of the limb, the majority of patients having been lost sight of after healing of the wound. The joints affected were the knee (34), the elbow (32), the shoulder (20), the ankle (12), the wrist (7), the hip (4), and the sacro-iliac articulation (2). Eight patients died, a total mortality of 7 per cent. Of the cases of purulent arthritis of the wrist, 7 were resected and all recovered. Of the elbow, 5 underwent arthrotomy only and all recovered; 9 in addition underwent secondary resection, and all of these also recovered; among the 18 cases in whom a more or less typical resection of the joint was of necessity performed at the onset, one death occurred. Of 20 cases of suppurative arthritis of the shoulder 2 were treated at the onset by resection and recovered; 18, of whom 1 died, underwent secondary resection. For purulent arthritis of the ankle 12 operations were performed, of which 2 were amputations; all recovered with the exception of one of the amputation cases. Of the 34 cases of suppurative arthritis of the knee 21 were submitted to arthrotomy, resulting in 20 recoveries and 1 death; 4 were treated by resection, of whom 1 died and another, owing to symptoms of infection, was obliged to undergo amputation; in 9 other cases recourse to amputation proved necessary. Out of a total, therefore, of 10 amputations there were 7 recoveries and 3 deaths. Finally, in cases of suppurative arthritis of the hip, 4 resections gave 4 recoveries.

Diphtheria in the Army.

In a study dealing with the work of a diphtheria service Dr. Louis Rue calls attention to the necessity of employing large doses of serum, especially under certain conditions. This, although a cardinal point in treatment, is insufficiently recognised by some practitioners. Under pre-war conditions an average dose of 120 to 150 c.c. of serum in each case had reduced the total mortality to 3·45 per cent., and only a very small number of cases of diphtheritic paralysis were seen. Dr. Orticoni, who is an advocate of large doses of serum, found on his arrival at an infectious hospital base 20–25 and even 29 per cent. mortality from certain sections of the front where doses of 50–60 c.c. daily were employed; while numerous cases of generalised paralysis resulted during convalescence. Orticoni systematically introduced the method of large and repeated doses. In cases of average severity he injected some 300 to 500 c.c. in the course of the disease; in severe cases 700 to 1000 and even 1800 c.c., commencing with doses of 100 to 120 c.c. daily in two injections. During a period of seven months he treated thus 208 cases of diphtheria, with only a single death. Albuminuria became infrequent, and only two or three patients passed at any time as much as 0·1–0·3 per cent. of albumin. Albuminuria is no contra-indication to serum treatment; on the contrary, if applied in the course of a case of moderately acute diphtheritic albuminuria the albumin rapidly disappears. The only troublesome complications due to the serum were articular. Urticaria was frequent, affecting the abdominal walls, or more generalised, and attended with itching. Paralysis was rare. The serum should be continued two or three days after the false membrane has disappeared. Larger doses were employed when the false membrane was greyish in colour or diffluent, or when the surrounding mucosa was much affected. Bleeding from the mouth or nose, or blood-staining of the mucosa around the false membrane suggest the advisability of large doses, especially as the serum is not a negligible factor in increasing the coagulability of the blood. The fear of anaphylaxis was found to be quite illusory, as it could be avoided by a preventive administration of a dose of 1 to 4 grammes a day of calcium chloride and of injections of 1/4 of a milligramme of adrenalin. M. Rue indicates a symptom which might be disturbing to a doctor who had not been warned. In certain cases a localised arthralgia occurs in the temporo-maxillary articulations, occasionally affecting the cervical and dorsal spine. The resulting trismus and rigidity of the spine then suggest tetanus. The fact of a previous injection of serum and the frequent co-existence of urticaria lead to a correct diagnosis.

"Jigsaw" Autoplasty.

M. Morestin recently made a communication to the Academy of Medicine on a form of autoplasty which does not require any addition of foreign tissue. At most it is necessary to take smallish strips from the immediate neighbourhood of the injury, for whereas deformity is often considerable the actual loss of substance may be very slight or even nil. The tissue debris, scattered in irregular rents, shrivelled, or rolled up, are still generally living. To turn these fragments to good account it is necessary to begin with the methodical removal of cicatrices, scrupulously respecting all that remains of the healthy soft tissues. Strips of mucosa are isolated without paying much attention at first to their method of disposal. Dissection must be patient and complete, and the greatest possible mobility of the wound secured by dividing all adhesions. At this stage the question arises of bringing together and reuniting the fragments. Little by little the best arrangement is found, the operator being guided all the time by the facts he ascertains. In this form of reparative surgery no two cases are identical. Sometimes the results obtained may be improved by touching up later, but in many cases they are perfect from the first. Jigsaw autoplasty has extensive indications in all injuries of the face, especially in mutilations of the lips and the cheeks. General anæsthesia is hardly ever necessary.

April 16th.

URBAN VITAL STATISTICS.

(Week ended April 7th, 1917.)

English and Welsh Towns.—In the 96 English and Welsh towns, with an aggregate civil population estimated at nearly 17,000,000 persons, the annual rate of mortality was 17·3, against 16·9 and 18·0 per 1000 in the two preceding weeks. In London, with a population exceeding 4,000,000 persons, the death-rate was 16·9, or 1·2 per 1000 below that recorded in the previous week; among the remaining towns the rates ranged from 7·0 in Cambridge, 7·7 in Oxford, and 7·8 in Hornsey, to 28·0 in Middlesbrough, 28·5 in Great Yarmouth, and 29·8 in Warrington. The principal epidemic diseases caused 438 deaths, which corresponded to an annual rate of 1·3 per 1000, and included 279 from measles, 56 each from whooping-cough and infantile diarrhœa, 36 from diphtheria, 8 from scarlet fever, and 3 from enteric fever. The deaths from measles showed a further increase compared with the numbers recorded in the 10 preceding weeks, and caused the highest annual rates of 3·4 in Bolton, 3·6 in Middlesbrough and in Sunderland, and 6·3 in Dudley. The 755 cases of scarlet fever and the 1297 cases of diphtheria under treatment in the Metropolitan Asylums Hospitals and the London Fever Hospital were respectively 40 and 80 below the numbers remaining at the end of the previous week. Of the 5627 deaths from all causes in the 96 towns, 191 resulted from violence. The causes of 64 of the total deaths were uncertified, of which 16 were registered in Birmingham, 5 in Liverpool, and 4 in Gateshead, but only 1 in London.

Scotch Towns.—In the 16 largest Scotch towns, with an aggregate population estimated at nearly 2,500,000 persons, the death-rate was equal to 16·9, against 16·2 and 17·9 per 1000 in the two preceding weeks. The 386 deaths in Glasgow corresponded to an annual rate of 18·0 per 1000, and included 34 from whooping-cough, 23 from measles, 6 from infantile diarrhœa, 3 from diphtheria, and 1 from scarlet fever. The 121 deaths in Edinburgh were equal to a rate of 19·0 per 1000, and included 10 from measles, 8 from whooping-cough, and 1 each from diphtheria and infantile diarrhœa.

Irish Towns.—The 198 deaths registered in Dublin were equal to an annual rate of 25·9, or 3·4 per 1000 above that recorded in the previous week, and included 20 from measles, 3 each from whooping-cough and infantile diarrhœa, and 1 from diphtheria. The 190 deaths in Belfast corresponded to a rate of 25·2 per 1000, and included 8 from measles, 5 from infantile diarrhœa, 2 from enteric fever, and 1 from whooping-cough.

BLINDED SAILORS AND SOLDIERS IN EDINBURGH.—On April 12th Mr. Barnes, the Minister of Labour, visited the Scottish Blinded Soldiers' and Sailors' Hostel at Newington House, Edinburgh. The history and work of the hostel were explained to him by Dr. Burns and Mr. Sommerville Grieve, Mr. W. M. Stone, the superintendent, urging the disadvantage of centralising in London the training of blinded service men. After inspecting the hostel and workshops, Mr. Barnes said that the work at Newington House ought to have a part in any general scheme of organisation for blinded service men.

Correspondence.

"Audi alteram partem."

RADIATION IN MALIGNANT DISEASE.

To the Editor of THE LANCET.

SIR,—I have read with much interest the paper on this subject by Captain A. A. Russell Green and the leading article in your issue of April 7th. While in no sense wishing to decry the effect of radiation, I cannot help thinking that you and your correspondent have formed a far too sanguine opinion on insufficient data. I select for comment the treatment of rodent ulcer, a subject to which I have devoted long study, and which, in fact, forms the chief basis of your correspondent's paper, for he tells us that only two out of the 53 cases of "neoplasmata," on which he reports, were not rodent. Your correspondent bases his statistics, as far as I can follow them, on the mere healing of the rodent lesion, which I submit with confidence is a fallacious test. Thus in Table IV. we are told that 66 per cent. of the traced cases were "healed," but the detailed analysis in which the duration of the observation is mentioned, in 24 cases which remained healed, more than half of these (13 to be exact) had been under scrutiny for less than two years. Moreover, analysing the 25 cases of rodent ulcer in Table I., the most important from the author's standpoint, for these constitute the "traced healed cases," we find that only seven of the 25 cases had a longer duration than five years, a reasonable conclusion from which data is that these were comparatively early and small lesions, peculiarly amenable to treatment of any kind. And this conclusion receives some confirmation from a consideration of Table II., "traced unhealed cases," for of 14 such, seven were of longer duration than five years, and in three of the remaining seven the duration is not specified. The author therefore in his successful cases is probably dealing with small rodents as a rule.

Now if we make mere healing of the lesion the criterion of success it is obvious that no treatment can compare with excision, for here "healing" is practically immediate and complete. But tested by the sole criterion which is of real importance, the ratio of recurrence, the argument for excision is greatly weakened, for an examination of published statistics of the results of operation makes on the whole melancholy reading. Two years ago in a paper on Rodent Ulcer contributed by me to the *British Journal of Dermatology*, reference was made to a table published by Butlin, in which, of a large series of operated cases kept under observation for three years, recurrence took place in 63 per cent. And I believe that that period of observation, although it compares very favourably with your correspondent's data, is far too short to allow of a considered judgment as to ultimate values of competing treatments.

My personal opinion, expressed in the paper to which I have referred, is that a method of far wider application (for it is at the disposal of every practitioner, which is certainly not the case with radium) is the method of freezing with carbon-dioxide snow, a peculiarly valuable method in the small early rodent, and if practised at its first stages would, I am confident, materially lessen the toll of "unhealed" and inoperable cases.—I am, Sir, yours faithfully,

Wimpole-street, W., April 17th, 1917. E. GRAHAM LITTLE.

To the Editor of THE LANCET.

SIR,—In a leading article in THE LANCET of April 7th you advocate post-operative radiation in cancer. You say: "However favourable a case may appear, no surgeon can be sure that he has removed every trace of malignancy; or, indeed, that he himself has not scattered malignant cells *over the field of operation*" (italics mine). If this was the worst that could happen, immediate post-operative radiation might suffice to deal with it. But who shall say to what part of the body these cells may not be carried in the blood-stream? I have for years been advocating *pre*-operative, as well as *post*-operative, radiation, and perhaps you will allow me to quote from a contribution which I made to a discussion on "Radiation in Cancer," which was opened by Sir Alfred Pearce Gould at the annual meeting of the British Medical Association at Brighton in July, 1913. Having pointed out that with modern X ray technique a depressant effect can be produced upon cancer cells long before there is any injury to the skin, I said:—

> We know that whenever and wherever the knife is employed there is always a risk of disseminating malignant cells, which subsequently take root and flourish. It is not to be supposed, however, that this colonisation is allowed to take place without opposition on the part of the invaded tissues. Many of the would-be settlers are no doubt slain before they are able to propagate their kind. Some, nevertheless, usually escape, but if these specially vigorous cells were subjected to previous radio-therapeutic attack, their chances of post-operative survival would be materially lessened. A cancerous tumour in an early stage presents an opportunity for X ray therapy which is never repeated. The enemy is concentrated in close order, and can be assaulted in force. Every cancer cell which escapes removal will then be in a devitalised condition, and in the presence of tissues whose resisting power has been artificially heightened.

It has long been known that cancer grafts exposed to X rays will rarely "take." The present writer has in his possession pathological reports of cases of breast cancer which had been rayed for 3–4 weeks previous to operation. These reports stated that most of the cancer cells showed degenerative changes. Moreover, American workers have recently proved that *raying of the wound surface into which a graft is to be put* reduces by one-half the percentage of successful plantings.[1] This furnishes experimental proof of another principle for which the present writer has contended—viz., that the effect of X rays in stimulating the healthy tissues to resistance is quite as important as any directly depressant action upon the cancer cells. Disregard of this principle leads to dire results, as is sometimes seen in the extensive sloughing of normal tissues around a buried tube of radium.

You rightly deprecate any attempt to pit X rays against radium or *vice-versa*. May I point out, however, that any comparisons between X ray and radium effects are valueless unless exact details as to filtration, quality of ray, milliampèrage in tube, distance from skin, time, number and spacing of exposures are all given. For example, a "reaction" produced by soft unfiltered X rays has a significance quite other than a similar response produced by a very penetrating, heavily filtered Röntgen radiation. In the one case the reaction is rapidly provoked and involves surface cells only; any malignant tissue lying even a few millimetres below the surface is unaffected. In the other, response is more tardy, but the disturbance reaches to a depth of some centimetres. The bearing of these facts upon liability to recurrence is self-evident.

I am, Sir, yours faithfully,

FRANCIS HERNAMAN-JOHNSON.

Cavendish-square, W., April 8th, 1917.

*** Mr. Hernaman-Johnson states well-known views.—ED. L.

THE TECHNIQUE OF LUMBAR PUNCTURE.

To the Editor of THE LANCET.

SIR,—I have noticed twice lately, while performing lumbar puncture for cerebro-spinal fever, a phenomenon which might, if unrecognised, cause an error in diagnosis:—

1. In the first case the needle (Barker's) was inserted into the theca, and on withdrawing the trocar cerebro-spinal fluid came out at the normal rate—i.e., a drop every two or three seconds. The needle was then pushed in a little further and the fluid came out in a jet under considerable pressure. This occurred again in the same patient during a subsequent puncture.

2. In this case the fluid came out at the normal rate, but inserting the needle farther did not increase the rate of flow. As there were good grounds for suspecting cerebro-spinal fever, it was pushed on until felt to impinge on the body of the vertebra, with still no alteration in the rate of flow, even though the trocar had been reinserted. It was then withdrawn a little and the fluid came off in a jet under pressure.

In both cases puncture was performed under a general anæsthetic (C.E.).

If no fluid were obtained at all one would, of course, know the needle was blocked or that the theca had been missed, but when, on withdrawal of the trocar, the fluid is found to flow at a normal rate, a mistake in diagnosis might easily occur, especially as in early cases the fluid is often not even opalescent and contains few or no organisms.

[1] See "The Cancer Problem and the W ld War," Pract., March, 1917, p. 230.

As I have seen no mention of this in the literature, but have had two cases showing it within the last month, I thought that—though a small point—it might be worth mentioning to you.—I am, Sir, yours faithfully,

F. A. WILLIAMSON,
Temporary Surgeon, R.N.

April 8th, 1917.

*** The difficulty is a real one, and deserves more consideration than it has yet received."—ED. L.

THE SERVICES.

ROYAL NAVAL MEDICAL SERVICE.

To be temporary Surgeons: W. T. Beswick, E. D. Brosker, J. A. Hadfield, and R. McM. Bowman.

ARMY MEDICAL SERVICE.

Col. J. H. Daly is retained on the Active List under the provisions of Articles 120 and 522 Royal Warrant for Pay and Promotion, 1914, and to be supernumerary.

ROYAL ARMY MEDICAL CORPS.

To be temporary Majors: Temp. Capt. B. H. Slater, A. G. Phear, and R. O. Moon.

B. Crothers to be temporary Honorary Major whilst employed with No. 22 General Hospital.

The relinquishment of his temporary commission as Captain by Temp. Capt. R. A. Rankin, Canadian A.M.C., is cancelled.

Temporary Lieutenants to be temporary Captains: H. H. Hannigan, J. F. Gill, F. J. Strachan, F. B. Young, A. M. Masters, C. E. Molino, R. B. Radie, J. W. Potter, R. H. Bridge, G. C. Berg, E. L. Hopkins, L. M. Mayers, G. W. Young, T. P. Buist, C. E. G. Bateman, A. E. Foerster, W. G. Weston, G. B. Mason, W. H. Thomas, J. Hewat, B. A. Morgan, C. W. Walker, R. H. L. O'Callaghan, H. S. Gaskell, G. F. Forde, W. J. McIvor, R. J. P. Waugh, B. P. Allinson, T. W. Mason, G. J. Knaggs, R. W. Chapman, A. Walker, W. J. Evans, J. N. Deacon, F. A. O'Donnell, A. Pimm, P. Figdor, W. A. Curry, D. S. Taylor, W. J. Tulloch, C. Cairnie, W. K. Bell, D. L. MacKenna, G. F. Nelson, C. V. Kebbell, D. Rees, J. A. O'Dea, E. E. Chipp, G. C. W. Williams, C. A. R. Nitch, P. J. S. O'Grady, C. Weller.

C. R. Stewart to be temporary Hon. Captain, without pay or allowances, and S. E. T. Shann to be Hon. Captain while employed with No. 5 British Red Cross Hospital.

To be temporary Lieutenants: L. J. Hood, H. S. Thomas, G. F. Fismer, C. T. Galbraith, E. H. R. Altounyan, A. C. Meek, H. A. Lane, W. H. Johnston, A. N. Collier, G. H. F. Graves, G. M. Simpson, C. H. Booth, J. T. Brown, R. J. Duthie, A. W. Gill, J. H. Hall, J. A. Bateman, C. O. Bowman, A. Shelley, J. McCartney, M. B. Taylor, D. L. Davies, F. D. Simpson, L. du Vergé, L. D. H. Baugh, P. C. Bushnell, C. F. Hardie, H. B. Pare, H. G. White, L. A. H. Bulkeley, J. Gaff, E. D. Keane, H. S. A. Hogg, G. R. Dobrashian, Lieut. R. G. Hill, from 2nd East Anglian Brigade, R.F.A., T.F.; J. A. A. Boddy, F. C. H. Bennett, S. B. Couper, R. W. Pearson, J. E. English, A. C. Hallowes, A. H. Clough, H. G. Steel, J. P. McVey, W. B. Jack, R. J. Helsby.

To be temporary Honorary Lieutenants, without pay or allowances: E. K. Clarke, F. F. Tisdall.

Officers relinquishing their commissions: Temp. Capt. J. A. Mescall (on account of ill-health), Temp. Capt. R. M. Clarke, Temp. Capts. F. W. H. Hutchinson, J. P. Walker, A. H. Conder, A. Wiley, F. H. Rudge, N. G. Horner, R. Fielding-Ould, C. S. Pantin, A. C. Freeth, S. J. Henry, J. W. Wood, G. M. de Vine, W. C. McN. Dickey (on account of ill-health), F. D. Atkins (on account of ill-health); Temp. Hon. Capt. J. F. Mackay and Temp. Hon. Lieut. Richard S. Topham (having resigned their appointments under the British Red Cross Hospital, Netley); Temp. Lieuts. H. W. Paddell, J. Dunlop, C. L. Forde, J. K. Bell, S. A. McClintock, R. B. Gorst, J. L. Power, R. V. Murphy, C. Costello.

SPECIAL RESERVE OF OFFICERS.

Capt. P. S. Vickerman to be temporary Lieutenant-Colonel while holding a special appointment.

Lieutenants to be Captains: J. M. Courtney, G. R. Barry, M. McGillivray, T. D. Renwick.

Capt. J. H. Bayley to be Acting Lieutenant-Colonel which commanding a Field Ambulance.

Lieutenant on probation G. R. Waller relinquishes his commission.

TERRITORIAL FORCE.

Capt. (acting Lieut.-Col.) T. H. Chittenden reverts to the acting rank of Major on alteration in posting.

Capt. (temp. Major) W. D. Sturrock to be acting Lieutenant-Colonel whilst commanding a Field Ambulance.

Capt. B. G. Annis to be acting Major whilst in command of a Field Ambulance.

Capt. O. L. Appleton to be acting Lieutenant-Colonel whilst commanding a Field Ambulance.

Capt. G. C. E. Simpson to be acting Lieutenant-Colonel whilst commanding a Casualty Clearing Station.

Lieut. J. Steele to be Captain and to remain seconded.

Lieut. J. S. Ranson to be Captain.

Major (temp. Lieut.-Col.) L. P. Demetriadi relinquishes his temporary rank on ceasing to command a Casualty Clearing Station.

Capt. G. J. M. Martin relinquishes his commission on account of ill-health.

DEATHS IN THE SERVICES.

Surg.-Gen. Sir William Taylor, K.C.B., late Director-General of the Army Medical Service, on April 10th, aged 74, at Windsor. He joined the Army Medical Staff in 1864, and served in Canada and in India, where, through the Burma campaign, he was on the Staff of the Commander-in-Chief (mentioned in despatches). During the Chino-Japanese War he acted as Military-Medical Attaché to the Japanese Army. In the Ashanti Expedition, 1895-96, he was principal medical officer (promoted to the rank of surgeon-general). He was also principal medical officer of the expedition to Khartum in 1898, and was present at the Battle of Omdurman. From 1898 to 1901 he was principal medical officer in India, and afterwards Director-General of the Army Medical Service, which post he held from 1901 to 1904. He was created C.B. in 1898 and K.C.B. in 1902. He was a Knight of Grace of the Order of St. John of Jerusalem in England, and an honorary LL.D. of Glasgow University.

The War.

THE CASUALTY LIST.

THE following names of medical officers appear among the casualties announced since our last issue:—

Killed.

Capt. G. B. Bailey, Australian A.M.C.

Previously reported Missing, now reported Killed.

Capt. S. J. Linzell, M.C., R.A.M.C., qualified at Edinburgh in 1912, and held the appointment of house physician at the Royal Infirmary in that city, and was also an ex-President of the Royal Medical Society of Edinburgh. He obtained his captaincy in the R.A.M.C. in March, 1915, and was on the staff as a Deputy Assistant Director of Medical Services. The award of the Military Cross is announced in our "Honours List."

Died.

Capt. H. A. Lunn, R.A.M.C., qualified at Glasgow in 1902, and practised in India before the war. He joined the R.A.M.C. in 1914 and served in Gallipoli and elsewhere. He returned to India at the close of last year, and died in hospital there of fracture of the skull brought about by an accidental fall.

Capt. J. McC. Orme, R.A.M.C., qualified at Edinburgh in 1915, and thereupon joined up.

Missing, believed Drowned (in the Hospital Ship "Saita" mined in the Channel).

Capt. J. R. Gyllencreutz, R.A.M.C., was a student at St. Thomas's Hospital, London, and qualified in 1908. He held appointments at Wandsworth Infirmary, at Brentford Infirmary, and at the Royal Hospital, Portsmouth, and was in practice at Richmond, Surrey, prior to joining the R.A.M.C.

Capt. G. C. B. Hawes, R.A.M.C., was a student at St. George's Hospital, London, and qualified in 1893. He held house appointments at St. George's, and was in practice at Pangbourne, Berks (for which county he was a J.P.), before joining the R.A.M.C.

Capt. T. G. S. Hodson, R.A.M.C., was educated at Newcastle-on-Tyne and at the London Hospital, and qualified in 1893. He was in practice in Wimpole-street, London, at the time he joined the R.A.M.C.

Lieut. J. Naylor, R.A.M.C., was a student at St. Bartholomew's Hospital, London, and qualified in 1889. He held a surgical appointment at the Derbyshire General Infirmary, and was in practice at Tipton Green, Staffs, prior to joining the R.A.M.C. in October last.

Capt. H. G. Smith, R.A.M.C., was a student at St. Bartholomew's Hospital, London, and qualified in 1909. He held appointments at the Westminster Hospital and at the London Temperance Hospital, and for a time was resident surgeon at the Lord Derby War Hospital. He was assistant medical officer of health and assistant school medical officer to the borough of Croydon, where he joined the R.A.M.C. in July last year.

Wounded.

Capt. W. L. Cassells, R.A.M.C.

Capt. W. M. Penny, R.A.M.C., attached Yorkshire Light Infantry.

Capt. W. N. Gilmour, M.C., R.A.M.C., attached Royal Scots.

Capt. J. R. Kemp, M.C., R.A.M.C., attached Essex Regt.

THE HONOURS LIST.

The following awards to medical officers are announced:—

Distinguished Service Order.

Temp. Lieut. John Maximilian Hammond, R.A.M.C., attached Devonshire Regiment.

For conspicuous gallantry and devotion to duty in evacuating a large number of wounded under the most difficult conditions. He was himself subsequently wounded, and though both his feet were practically blown off he ordered his stretcher-bearers to carry away another wounded man first.

Bar to the Military Cross.

Temp. Capt. Ernest Emrys Isaac, M.C., R.A.M.C., attached Royal Fusiliers.

For conspicuous gallantry and devotion to duty. He worked continuously under very heavy fire and was responsible for the successful evacuation of the wounded. He set a splendid example of courage and determination throughout the operations.

(The award of the Military Cross was announced in THE LANCET of Oct. 28th, 1916, p. 770.)

Temp. Capt. Patrick Joseph Lane, M.C., R.A.M.C.

For conspicuous gallantry and devotion to duty. On several occasions he led out squads of stretcher-bearers under very heavy fire and succeeded in bringing in many wounded men. He set a splendid example of courage and determination throughout.

(The award of the Military Cross was announced in THE LANCET of Dec. 2nd, 1916, p. 958.)

Capt. Rudolph Albert Peters, M.C., R.A.M.C., attached King's Royal Rifle Corps.

For conspicuous gallantry and devotion to duty. He continually tended the wounded under very heavy fire. He set a splendid example and showed an absolute disregard for his own personal safety. He has on many previous occasions done fine work.

(The award of the Military Cross was announced in THE LANCET of Oct. 28th, 1916, p. 770.)

Temp. Capt. John Caruthers Sale, M.C., R.A.M.C., attached Royal Fusiliers.

For conspicuous gallantry and devotion to duty. He displayed great courage in collecting and dressing the wounded in the face of a very heavy hostile barrage. He set a splendid example to all ranks.

(The award of the Military Cross was announced in THE LANCET of Dec. 2nd, 1916, p. 959.)

Military Cross.

Temp. Capt. Victor Thomas William Eagles, R.A.M.C.

For conspicuous gallantry and devotion to duty. He organised and led search parties for wounded, and worked continuously under very heavy fire for over 24 hours. He set a splendid example of courage and determination throughout.

Capt. Norman Parsons Jewell, East African Medical Service.

For conspicuous gallantry and devotion to duty. He worked continuously for 62 hours, and, single-handed, attended to over 100 wounded men. He has on many previous occasions done fine work.

Temp. Lieut. Charles Gordon Kemp, R.A.M.C., attached Northern Regiment.

For conspicuous gallantry and devotion to duty. He worked unceasingly for two days under very heavy fire, and succeeded in evacuating a large number of wounded. He displayed great courage and determination throughout the operations.

Capt. Stanley James Linzell, R.A.M.C.

For conspicuous gallantry and devotion to duty in superintending the evacuation of the wounded. He continually visited the forward Battalion Headquarters, passing under very heavy fire. He set a splendid example of courage and determination throughout. (The death of this gallant officer is chronicled above.)

Temp. Capt. Thomas McCosh, R.A.M.C., attached Welsh Regiment.

For conspicuous gallantry when his aid post was subjected to heavy shell-fire for over three hours. He, with absolute disregard for his own personal safety, set a splendid example of courage and devotion to duty.

Temp. Surg. William James McCracken, R.N.

For conspicuous gallantry and devotion to duty. He continually attended to the wounded under very heavy fire. He has previously done fine work.

Temp. Capt. Herbert Walker, R.A.M.C.

For conspicuous gallantry and devotion to duty. He led his stretcher-bearers with great courage and determination for a period of 36 hours. It was due to his energy and resource that a large number of wounded were evacuated under the most trying conditions.

Capt. Gladston Montague Hunt, Australian A.M.C.

For conspicuous gallantry and devotion to duty. He showed an absolute disregard of danger and set a splendid example to his stretcher-bearers, working with them over ground continually swept by heavy fire. He worked for six consecutive weeks in a forward area in charge of an advanced dressing-station.

Capt. Harrie Bertie Lee, Australian A.M.C.

For conspicuous gallantry and devotion to duty in evacuating the wounded. He set a splendid example throughout and worked continually under very heavy fire. He has previously done fine work.

DEATHS AMONG THE SONS OF MEDICAL MEN.

The following sons of medical men must be added to our lists of those who have fallen during the war:—

Capt. V. O. Todd, Royal Lancaster Regiment, second son of Colonel O. Todd, A.M.S.

Brevet-Major H. E. Trevor, Northamptonshire Regiment, temporary Lieutenant-Colonel Essex Regiment, son of Surg.-Gen. Sir F. Trevor, K.C.S.I., C.B., of Steeple Aston.

Second Lieut. A. P. Webb, King's Shropshire Light Infantry, second son of Dr. H. P. Webb.

Second Lieut. G. S. Spence, South Wales Borderers, younger son of the late Dr. W. J. Spence, of Bedford.

Second Lieut. D. N. O'H. Humphry-Davy, Hampshire Regiment, younger son of Dr. A. Humphry-Davy, of Bournemouth.

MEDICAL MOBILISATION IN AMERICA.

The important part which medicine has taken in the war has been generally acknowledged and appreciated. When war was declared few people realised that it would develop on such a huge scale, or that the mobilisation of so large a proportion of the medical profession in the British Isles would be needed to supply the demands of the Army; yet in spite of these, the organisation of the medical profession has produced results which, when the true medical history of the war comes to be written, will redound to its credit. Coming into the war late America will have before her the vast medical experience of our own and other countries as well as her own gained in the prosecution of her beneficent Red Cross and other medical work on behalf of all the belligerents; but that she will also have to attend to her own domestic problems and that she has resolved firmly to do so is shown in a stirring leading article which appeared before the actual declaration of war with Germany. In the February issue of *American Medicine* the writer says: "'Lethargy, indifference, inaction have given way to enthusiasm, application, and devoted service. A nation of many component national factors has suddenly been welded into a homogeneous mass." In words which might equally apply to our own country, America's failure to realise her responsibilities as a Christian nation is pithily summed up thus: "In the midst of prosperity and material success, the nation has grown careless, indolent, and wasteful. National adolescence has been characterised by bombast, temerity, and extravagance." While recognising the need for the careful guidance of public opinion without jingoistic utterances and for patriotic inspiration free from cries for blood, it is pointed out that "If there must be war, let it be approached with grimness and determination as an unpleasant duty to be performed, marshalling the best brains and brawn of the nation for the performance of the various duties for the successful determination of an early and permanent peace." The duties of the medical profession being protective and restorative and its services valuable to friend and foe alike, its thorough organisation is demanded and the article continues, "On the brink of conflict, it is time to pause and contemplate the constructive possibilities for true patriots. How can the medical profession best serve the nation? There should be not merely the development of new organisations requiring new machinery, large funds, and scattered centres of interest, but the physicians of the nation, as a whole, should be organised as far as possible through the normal agencies now existent." From all this it seems clear that America, who remained neutral while she could do so without dishonour, has resolved now to enter the quarrel in a spirit of determination which should help to bring about the peace for which the whole civilized world is praying.

THE WAR AND HOSPITAL SHIPS.

Our columns this week contain two reminders of the merciless nature of the present naval warfare and the dangers to which the officers and men of the Royal Army Medical Corps are exposed on hospital ships. When the *Salta* struck a mine in the Channel during bad weather on April 10th five medical men holding commissions, as well as nine nursing sisters and 38 orderlies, are presumed to have been drowned. Lieutenant-Colonel A. G. P. Gipps's interesting surgical experiences on the *Asturias* remind us that that ill-fated vessel, after successfully evading attack by a submarine in February, 1915, was torpedoed on the night of March 20th–21st last, when the casualties among the medical services on board included 11 dead, 3 missing (a female staff-nurse among them), and 17 injured. Ten days later the *Gloucester Castle* was torpedoed, all the wounded on board being saved. A new element has thus been introduced into the terrors of warfare and even the wounded man is no longer immune from further injury.

Various Experiences in a Hospital Ship.

The following experiences in a hospital ship, entitled "Notes from H.M.H.S. *Asturias*," are recorded by Temporary Lieutenant-Colonel A. G. P. Gipps, R.A.M.C. (T.C.):—

This ship has been employed as a hospital ship by the War Office since the middle of August, 1914, of which time I have been in command some 17 months. Some 350 to 400 operations have been performed on board, entirely by the staff of the Royal Army Medical Corps, which consisted of six medical officers besides myself.

On one voyage some 40 cases of gas gangrene occurred, all in patients taken off Gallipoli during the fighting. The gangrene spread so rapidly as to be almost visible in its advance, especially in the trunk. None of the various treatments at all seemed to modify the attacks. Some lives were

seemingly saved by amputation high up where the extremities were attacked, even when tissues cut through at the time of operation were far from healthy. The very high summer temperature—90° to 104° F.—and the fact that there seemed to be millions of flies on board may have had something to do with its virulence and prevalence.

For cases of tetanus the various intrathecal injections recommended were used—presumably all the cases had been inoculated when wounded. The treatment of the cases occurring on board here, though pushed to the extreme, seemed in no way to control the disease, and we fell back on morphia and chloroform to relieve the severe spasms. One of the most remarkable outbreaks of tetanus occurred in the cases of frost-bite with (1) moist and (2) dry gangrene, of which we received a number of cases from the Serbian frontier, where there were 23° of frost in the end of November and early in December. The onset was quite sudden, and was fatal within from 16 to 24 hours. This was confirmed to me by other medical officers who dealt with these cases. Treatment in no way affected them.

The external iliac artery was tied three times for hæmorrhage high up from the femoral in Scarpa's triangle.

A few short notes of two cases of special interest are appended.

CASE 1.—Private, received from the trenches on Gallipoli. He was suffering from a wound just to the left of the sternum in the fourth intercostal space partially perforating the sternum. On the fifth day after his arrival on board a severe hæmorrhage occurred, which was temporarily controlled by plugging whilst the patient was being conveyed to the operating table. On removing the plug the bleeding recurred with great violence. The wound being deep and small, I turned up the left breast to expose the intercostal muscles. The bleeding point could not be distinguished, but could be partially controlled by digital pressure. At last, after several attempts, a pair of pressure forceps caught a portion of the severed vessel, and it was then possible to open up the wound, and the bleeding was controlled by the further application of forceps. On passing the finger behind the sternum the nickel casing of a bullet was found lying on the pericardium; it was squeezed flat into a knife-edge, and the heart's action was sawing it up and down, and had divided the internal mammary artery. I removed the bullet casing (see figure), tied the internal mammary in the second interspace, and removed the controlling forceps. The breast, which had been reflected, was replaced and stitched in place. The patient had no further trouble.

Showing size and shape of bullet casing removed from pericardium.

CASE 2.—Private, received on board from the fighting in Serbia. He was in a very bad way: the left patella had been shattered some days previously, and only some fragments remained. The wound in front of the knee-joint was as large as my hand. Temperature 104° F.; pulse 120. The wound was cleansed, dressed, and the leg temporarily put up on a back-splint with foot-piece. The next day, the patient being worse, with severe pain, and the temperature over 104°, he was placed on the operating table. Both synovial pouches in front of the joint and the whole of the joint itself were found full of stinking pus and dirt. I laid the whole joint widely open and flushed and washed out with sterile saline the synovial pouches and the rest of the joint and removed the remains of the patella. A drain of broad rubber tape was placed on the outer side of the knee, draining through an opening made on the outer side of the popliteal space. Finally, with a view of sterilising if possible the entire joint, it was thoroughly flushed out with ether, the ether being allowed to remain in place some two minutes each time, then squeezed out, and replaced with fresh; this was repeated some half-dozen times. That night the temperature fell to 99·4°, and in the morning was only just above normal. The wound throughout was dressed with dry sterilised gauze, wrung out in sol. hyd. biniod., 1 in 1000, made practically dry. The drainage-tape was removed at the end of 14 days. From the day of the operation the patient never looked back—from being almost a skeleton he became fat and healthy. The granulating wound, which was, of course, very extensive, after six weeks I grafted in about 14 places, of which 11 grafts took. When healed over the leg was put up in plaster-of-Paris, covering the knee-joint and extending 6 inches above and below the joint. The patient was daily carried on deck, and within three months of coming on board was able to walk about the ship with the nominal assistance of a walking-stick, which, however, he used but little. There was, in spite of the loss of the patella, a certain amount of power of extension left.

Medical News.

EXAMINING BOARD IN ENGLAND BY THE ROYAL COLLEGES OF PHYSICIANS OF LONDON AND SURGEONS OF ENGLAND.—At the quarterly examination in Practical Pharmacy held on April 12th the following candidates were successful:—

Ernest Horace Bryant and William Barnes Buer, Guy's Hospital; Horace Braithwaite Bullen, Cambridge University and St. Bartholomew's Hospital; Charles Grinling Bunn, Cambridge University and Charing Cross Hospital; Benjamin Young Harper Christmas, Middlesex Hospital; John Rudolph Cox, Guy's Hospital; Edward Ernest Elt, Charing Cross Hospital; Mendel Gourevitch, London Hospital; Norman Bernard de Medina Greenstreet, Cambridge University and St. Thomas's Hospital; Oliver Halstead and Walter Ralph Gill Hearnden, Guy's Hospital; Gilbert Rashleigh Hull, St. Thomas's Hospital; John Powell Jones Jenkins, University College, Cardiff, and Westminster Hospital; Montagu Horace Jupe, London Hospital; Salomon Kadinsky, Brussels, King's College, and Westminster Hospital; Charles William Lakin, Birmingham University; Archibald Magill, Guy's Hospital; Ahmed Othman, King's College; Gerald Richardson Sharp, London Hospital; Jacques Spira, St. Thomas's Hospital; Doris Kathleen Shuttleworth, Leeds University; Thomas Cowley Stephen, Manchester University; Ronald Henry Tasker, Bristol University; Joseph Stanley Thomas, London Hospital; John Henry Tighe, Birmingham University; Jose Victory, Guy's Hospital; and Arthur Winfield, Cambridge and Liverpool Universities.

UNIVERSITY OF LONDON.—At examinations held recently the following candidates were successful:—

SECOND EXAMINATION FOR MEDICAL DEGREES, PART II.

Iskander Mikhail Abd-El-Said, King's College; Julia Bell and Hilda Crichton Bowser, London School of Medicine for Women; John Vernon Cannadine Braithwaite and William Mark Brown, Guy's Hospital; Michael Waldo Boone Bulman, London Hospital; *Alix Jeanne Churchill, London School of Medicine for Women and King's College; Harris Cohen, University College, Cardiff; Hyman Solomon Cohen, London Hospital; Morris Cohen, Guy's Hospital; *Simeon Moses Cohen, University College, Cardiff, and St. Bartholomew's Hospital; Ursula Beatrice Cox, London School of Medicine for Women; James Fannin g, London Hospital; Raymond Eustace Ford, University of Sheffield; Reginald Stafford Foss, St. Thomas's Hospital; Pinkus Joseph Freilich, King's College; Dennis Herbert Geffen, University College; Jacob Gorsky, King's College and Westminster Hospital; Dorothy Margaret Greig, †¶Hilda Treloggen Haggett, *Edith May Hall, and Joan Margaret Redford Harris, London School of Medicine for Women; †Henry Lewis Heimann, University College; *Oscar Stanley Hillman, Middlesex Hospital; Graydon Hume, Guy's Hospital; Hassan Kamal, King's College; *Reginald Cyril Bell Ledlie, Guy's Hospital; Gdal-Leizer Levin, King's College; Hyman Jacob Levy, University College, Cardiff, and St. Bartholomew's Hospital; Leslie Lyne, Guy's Hospital; Charles Dundas Maitland, St. Thomas's Hospital; Ida Caroline Mann, London School of Medicine for Women; Grant Massie, Guy's Hospital; ¶Kathleen Harding Matthews and Sybil Gertrude Overton, London School of Medicine for Women; Jal P stonji Padshah, University College; ¶Dorothy Pantin, London School of Medicine for Women; Wilfrid Walter Payne, Guy's Hospital; Norah Dorothy Pinkerton and Beatrice Davidine Pullinger, London School of Medicine for Women; Charles Nathaniel Read and Henry Elliott Reburn, King's College; Eleanor Margaret Reece, London School of Medicine for Women; Rowan William Revell, University College; Esther Rickards, London School of Medicine for Women; Samuel Rosenschein, Charles Herbert St. John, and Albert Ernest Sawday, Guy's Hospital; Ruth Mary Scutt and Olive Ballance Sharp, London School of Medicine for Women; Campbell Shaw, St. Bartholomew's Hospital; Marguerite Garnett Sheldon, University of Liverpool; Ernest Livingstone Sergeant, London Hospital; Vanda Patten Thomas, London School of Medicine for Women; Alfred Basil Keith Watkins, London Hospital; Eric Roland Webb, Guy's Hospital; and Jane Edith Wood, University of Leeds.

* Distinguished in Anatomy. † Distinguished in Physiology.
¶ Distinguished in Pharmacology.

SOCIETY OF APOTHECARIES OF LONDON.—At examinations held recently the following candidates were successful:—

Materia Medica and Pharmacy.—H. P. Hodge, Oxford; J. Stephen, Manchester; and T. T. Tiplady, Durham.

Anatomy.—L. Bernstein, King's College; K. J. H. Davies, Guy's Hospital; J. L. Delicati, Bristol; J. Flanagan, Liverpool; H. D. Hoggard, Middlesex Hospital; J. S. Jones, University College Hospital; M. S. Jones, Manchester; M. Korn, London Hospital; L. E. Lewis, Cardiff and Glasgow; A. McKenzie, Guy's Hospital; J. A. Marriott, Manchester; G. G. Newman, London Hospital; H. E. Reburn, King's College; W. H. Shipway, Bristol; N. G. Thomson, Cambridge; T. T. Tiplady, Durham; and W. G. D. H. Urwick, St. Bartholomew's Hospital.

Physiology.—L. Bernstein, King's College; K. J. H. Davies, Guy's Hospital; J. L. Delicati, Bristol; J. Flanagan, Liverpool; H. D. Hoggard, Middlesex Hospital; W. T. Johnson, Birmingham; M. S. Jones, Manchester; M. Korn, London Hospital; L. E. Lewis, Cardiff and Glasgow; A. McKenzie, Guy's Hospital; J. A. Marriott, Manchester; G. G. Newman, London Hospital; H. E. Reburn, King's College; S. K. Rigg, Bristol; S. Robinson, Belfast; W. H. Shipway, Bristol; N. G. Thomson, Cambridge; W. G. D. H. Urwick, St. Bartholomew's Hospital; and A. A. Weinger, King's College.

ROYAL COLLEGES OF PHYSICIANS AND SURGEONS OF EDINBURGH AND ROYAL FACULTY OF PHYSICIANS AND SURGEONS OF GLASGOW.—At examinations held recently the following candidates were successful:—

SECOND EXAMINATION.

Lizzie Robertson Clark, Angus Macdonald, Frank Arthur Smorfitt, George Coote Field, Donald Macdonald MacLeod, Robert Berry Forgan, Walter Granville Carew, Thomas Arnoldus du Toit, John Binnie Taylor, and William Harvie Kerr.

Physiology.—John Murray.

THIRD EXAMINATION.

Thomas Blaney, Thomas Ferguson Minford, Alan Herbert Brookr Hudson, Hugh William Howatson, William Gibb, Jung Bahadue Singh, Rebecca Goodman, Andrew Wood Smith, Norman Joseph Patterson, and John Alfred Alexander Duncan.

Materia Medica.—**Andre Antoine Lamaletie, Alexander Forsyth Caddell, Philip George Bainbridge, and Charles Leonard Webb Fleming.**

FINAL EXAMINATION.

William Archibald Mein, John Adami, Frederick Joseph Jack, Alfred Edwin Elliott, and William McElroy.

Medicine.—**John Boyd and Samuel Amery Faulkner.**

Surgery.—**William Ulic Desmond Longford, Phœbe Foott, Frank Moffat Haldane Sanderson, and Jackson Baird Minford.**

Midwifery.—**William Ulic Desmond Longford, Harold Congoult Smith, Frank Moffat Haldane Sanderson, John Lavens West, and Jackson Baird Minford.**

Medical Jurisprudence.—**Hendrik Wildeboor, Daniel Colin McNair, Lewis Windermere Nott, Eliza Jean Stuart, Mahmoud Abdel Kader Mofreh, Ernest Ebenezer Bronstorph, and James Henry Brown.**

UNIVERSITY OF GLASGOW.—**In the examination** for the degrees of Bachelor of Medicine (M.B.) and Bachelor of Surgery (Ch.B.), held recently, the following candidates were successful in the subjects indicated—A., anatomy; P., physiology; M., materia medica and therapeutics; Path., pathology:—

John Smith Aitken (A., P.), Carl Otto Anderson (M.), John David Arthur (M.), William Barras (Path.), Alexander Shanks Bisset (M.), Donald Cameron Bowie (Path.), Donald Campbell Buchanan (Path.), William George Burns (M.), Malcolm Chalmers (M.), Alexander Ebenezer Cochrane (Path.), Alexander Conner Connell (Path.), George Michael Cooper (A., P.), Cyril Lockhart Cottle (M.), Harold Livingstone Coulthard (M.), Edward Mitchell Erskine Cumming (Path.), Andrew Murdoch Davidson (M.), John Donald (M.), John Campbell Dow (M., Path.), Basil William Henry Fergus (M.), Thomas Fleming (Path.), Allan Donald Fraser (M., Path.), Kenneth John Alexander Gillanders (Path.), George Osmond Grant (M.), Peter Fife Auchinachie Grant (Path.), James Alexander Moore Hall (A., P.), James Anthony Hamilton (M., Path.), John Forrest Hamilton (M.), Humphrey Josh Hollis (M.), George Jamieson (P.), John Alexander Jenkins (Path.), Arthur Kennedy (M., Path.), John Kirk (M.), James Campbell Laurie (M., Path.), Douglas Marshall Lindsay (A.), Alan James MacArtney (M., Path.), Duncan MacColl (Path.), Robert M'Courtney (M.), Walter Stewart M'Intyre (A., P.), Donald Mackenzie (A., P.), Andrew Aird M'Laughland (A., P.), Angus Maclean (M., Path.), Donald Maclean (M.), John Macleod (M., Path.), Roderick Montague Macpherson (P.), John Spence Meighan (M.), Sylvester Henry Meiring (M.), George Macleod Millar (A., P.), Livingstone Mitchell (M.), John Nicol (M.), John Nicolson (Path.), John William Peden (M.), Andrew Glen Petrie (A., P.), John Browning Potter (Path.), Rahmat Ullah Qureshi (Path.), Francisco Ribeiro (M.), James Morrison Ritchie (M.), Ian Menteith Robertson (Path.), Joseph Sachs (P.), William Scotland (Path.), William Scott (A., P.), Ralph Paterson Smith (M., Path.), Herbert Harold Spencer (A., P., M.), Donald Stewart (P., M.), Alexander Strang (A., P.), John Leonard Turpie (A., P.), Alexander Ross Waddell (Path.), James Alexander Walls (A.), Hugh Wands (M., Path.), and William Alexander Wilson (A., P.).

Women.—**Ellen Davidson Anderson (Path.), Marjorie Mason Anderson (A., P.), Annie Burns Cameron (P.), Grace Chatterton (Path.), Louise Denil (A., P.), Charlotte Ann Douglas (A., P.), Margaret Hogg Grant (M.), Margaret Gray (A., P.), Lillias Beverley Hardie (Path.), Alison Mary Hunter (M.), Margaret Logan (P.), Isabella Quarrier M'Fadzean (Path.), Ellen Thomson MacKenzie (A., P.), Annie Isabel Christian Maclardy (A., P.), Florence Frances Mitchell Milne (M.), Kathleen Nicol (M.), Vida Johnston Perry (M.), Margaret Nelson Robertson (M.), Eliza Dorothea Sandison (P.), Katherine Scott (M., Path.), Jane Elder Shortt (Path.), and Catriona Sinclair (P.).**

Third Professional Examination (Old Regulations).—**Thomas Crawford (M.).**

The following have passed in Medical Jurisprudence and Public Health of the Fourth Professional Examination (New Medical Ordinance):—

Roderick Bethune, Donald Campbell Buchanan, Basil William Henry Fergus, George Keith Fulton, James Biggam Douglas Galbraith, Adam Smith Goudie, James Charles Hendrie, Donald Macqueen, William M'William, Archibald Sutherland Strachan, and Joseph Turner Taylor.

Women.—**Annetta Gillies Turnbull Anderson, Mabel Nellie Blake, Margharita Mary Lamont Couper, Grace Anderson Fleming, Jane Evelyn Hanson, Janet Whyte Hepburn, Mary Reid Knight, Agnes Purcell M'Gavin, May Constance Boughton Leigh, Margaret Turner M'George, Jessie Napier Robertson, Agnes Petrina Routledge, Dorothea Helen Suttie, and Lydia Ida Huber Torrance.**

The following have passed in Medical Jurisprudence and Public Health of the Third Professional Examination (Old Medical Ordinance):—

Thomas Watson Carstairs, Thomas Fleming, and John Nicolson.

The following candidates passed the whole of the examinations for the above degrees:—

John William Waddell Baillie, Monindra Nath Bhattacharjee Archibald M'Allister Blackwood, Mabel Nellie Blake, John MacDougall Clark, Andrew Dick, Samuel Norman Dykes, Lewis Livingstone Fotheringham, Margaret Hutchison Glen, William Hadden Gordon, David Heard, Frederick William Hebblethwaite, Henry Fielden Hollis, James Robert Riddell Holms, William Hogarth Kerr, James Liddell, Frederick Colquhoun Logan, Kenneth M'Alpine, Arthur Daniel Clark M'Gowan, May Elizabeth MacIver, Donald William Morison MacKenzie, William Duff Miller, William Harold Palmer, James Walker Patterson, May Isabella Turner Reid, Angus M'Alpine Scott, Henry Buchan Sergeant, Andrew Wauchope Smith, Clarence Lorraine Somerville, Douglas Stuart Stevenson, Pat Adam Stewart, Marion Watson, Mary MacLean Weir, Robert Wiggins, and John Thomas Wylie.

UNIVERSITY OF DUBLIN, TRINITY COLLEGE, SCHOOL OF PHYSIC.—At the recent Hilary examinations the following candidates were successful:—

INTERMEDIATE MEDICAL EXAMINATION.

Part II., Anatomy and Physiology.—**Wonter de Vos Scholtz, Harris Cohen, Henry Allman Lavelle, Donal Victor Latham (omitting Organic Chemistry), and Johan Frederick Wicht (omitting Organic Chemistry).**

Applied Anatomy and Applied Physiology.—**Thomas Henry Coolican (high marks), Reuben Resnekov (high marks), Richard Counihan, Noelle Long, Henry Blundell Van der Merwe, John Gerrard Holmes, Alewyn Johannes Vorster, Gertrude Rice, John Charles Callanan, Albert Hugh Thompson, Jan Jacobus Gabriel de Kock, Victor George Walker, John Farneworth Sheppard, Arthur Leslie Gregg, Cyril Daniel Brink, Becher FitzJames Haythornthwaite, Cecil Joseph Quinlan, Abgar Read Aiden, Richard Dominic Murphy, Thomas James Russell Warren, Richard William Shaw, Harris Cohen, William Andrew Byrn, Samuel John Laverty, William Richard Burns, Athanas Blagoff, William Joseph Hogan, Jessie Gilbert, Lionel Wigoder, Johannes Tobias Mynhardt, and Alfred John Beckett.**

FINAL EXAMINATION.

Part I., Medical Jurisprudence and Hygiene, Materia Medica and Therapeutics, Pathology.—**William Leech Young (high marks), Robert Meade Daly Devereux (high marks), Johannes Cornelis Fouché, Eric James Lyndon, Leslie James Nugent, John Benson McGranahan, Eric Stuart Mack, Kenneth MacGregor Greer, Olive Gertrude Blackam, Frank Ferguson, Benjamin Dames Merrin, Frederick John Dymoke, Francis John Gerrard Battersby (omitting Pathology), *Arthur Leslie Gregg, *Francis Assisium McHugh, *Bryan Austin McSwiney, *William Alfred Shannon, *Eric Reginald Tivy, and †Margaret Wolfe.**

*** Pathology completing examination.**

† Medical Jurisprudence and Hygiene completing examination.

Part II., B.A.O., Midwifery and Gynæcology.—**Edward D'Arcy McCrea, Alexander Richard Barlas, Bryan Austin McSwiney, Margaret Wolfe, Percy Crowe Parr, Joseph Roland Brennan, Hastings Harley Molloy, Thomas Tabuteau, Paul Herbert Shelly Smith, Patrick Casey, Thomas Hugh Robinson McKiernan, and John James Keatley.**

B.Ch., Surgery.—**James Arthur William Cullen (high marks), George Bernard Shaw, Henry Banks, Henry James Rice, Paul Herbert Shelly Smith, and Hirsh Brill.**

M.B., Medicine.—**Alexander Richard Barlas (high marks), Edward D'Arcy McCrea (high marks), James Carter O'Gilvie, Paul Herbert Shelly Smith, William Frederick Wicht, Olive Gertrude Blackham, Pieter Johannes Swanepoel, Willem Petrus Lubbe, Gilbert Marshall, James Arthur William Cullen, Thomas Edward Hill, and Hastings Harley Molloy.**

Dental (B. Dent. Sc.).—**John Henry James Stuart.**

DIPLOMA IN PUBLIC HEALTH (D.P.H.).

Part I., Chemistry, Meteorology, and Bacteriology.—**Thomas Kirkwood and Bagenal Harvey Mellon.**

Part II., Sanitary Engineering, Vital Statistics, Hygiene, and Epidemiology.—**Bagenal Harvey Mellon.**

LITERARY INTELLIGENCE.—**Mr. Heinemann** announces the immediate issue of a treatise on Malingering by Dr. A. Bassett Jones and Dr. R. Ll. J. Llewellyn.

THE Council of the Medical Society of London have awarded the Fothergillian medal for 1917 to Sir Leonard Rogers, I.M.S., C.I.E., F.R.S., of the Medical College, Calcutta, in consideration of his work on Dysenteries, their Differentiation and Treatment.

THE Society of the Swedish Physicians (Svenska Läkaresällskapet) has elected Colonel Robert Jones, C.B., Inspector of Military Orthopædics, to be a foreign member of the society. The honour was conferred at the instance of Dr. Haglund, professor of orthopædics, Stockholm, supported by the professor of surgery, Dr. John Berg, and by Dr. Henning Waldenström, lecturer on orthopædics.

ROYAL SOCIETY OF ARTS.—**The following lectures** will be delivered during April and May on Wednesday afternoons at 4.30:—April 25th, Sir Francis Fox on Flour and Bread; May 2nd, Mr. J. C. Shenstone on Herb Growing in the British Empire; May 16th, Sir C. Arthur Pearson on the Blind Sufferers from the War and their Future Employment.

PAYMENT FOR THE DOMICILIARY TREATMENT OF TUBERCULOSIS IN BELFAST.—A Belfast correspondent writes:—"Three members of the city council of Belfast—Dr. J. D. Williamson, Dr. R. Thomson, and Dr. S. Allworthy—have resigned in order to make their position clear in connexion with payments made to them by the council for the domiciliary treatment of pulmonary tuberculosis (see THE LANCET, April 7th, p. 556). Probably when the new Municipal Bodies Emergency Act is passed the whole question will be put upon an entirely different footing."

Appointments.

Successful applicants for vacancies, Secretaries of Public Institutions, and others possessing information suitable for this column, are invited to forward to THE LANCET *Office, directed to the Sub-Editor, not later than 9 o'clock on the Thursday morning of each week, such information for gratuitous publication.*

BOYD, R. M., M.B., Ch.B. Aberd., has been appointed Certifying Surgeon under the Factory and Workshop Acts for the Braemar District of the county of Aberdeen.

FISHER, H. R., M.B. Camb., Certifying Surgeon under the Factory and Workshop Acts for the Atherstone District of the county of Warwick.

HIGGIN, ROBERT FRANCIS, B.A., M.D., B.C. Cantab., L.R.C.P., M.R.C.S., Acting Medical Officer to the Newton Abbot (Devon) Union Workhouse.

PROCTER, J. A., L.S.A. Lond., Certifying Surgeon under the Factory and Workshop Acts for the Lydd District of the county of Kent.

Vacancies.

For further information regarding each vacancy reference should be made to the advertisement (see Index).
When the application of a Belgian medical man would be considered the advertisers are requested to communicate with the Editor.

ANGLO-RUSSIAN HOSPITAL, 32, Victoria-street, S.W.—Two Surgeons for Russia.

BARNSLEY, BECKETT HOSPITAL.—Honorary Staff for Out-patients (Two Vacancies).

BARROW-IN-FURNESS, NORTH LONSDALE HOSPITAL.—Second House Surgeon. Salary £250 per annum, with board, &c.

BETHNAL GREEN INFIRMARY, Waterloo House, Waterloo-road, E.—Assistant Medical Officer. Salary at rate of £250 per annum.

BOLTON INFIRMARY AND DISPENSARY.—Second House Surgeon. Salary £200 per annum, with board, &c.

BOURNEMOUTH, ROYAL VICTORIA AND WEST HANTS HOSPITAL, Boscombe Branch.—House Surgeon. Salary £125 and extras, with board, &c.

BRADFORD CITY EDUCATION COMMITTEE.—Temporary Assistants to School Medical Officer.

BRISTOL ROYAL INFIRMARY.—House Physician and House Surgeon. Salary at rate of £120 per annum, with board, &c.

BURNLEY, VICTORIA HOSPITAL.—House Surgeon. Salary £160 per annum, with board, &c.

BURNLEY UNION.—Resident Assistant Medical Officer. Salary £300 per annum, with rations, &c.

BURY INFIRMARY.—Junior House Surgeon. Salary £150 per annum, with board, &c.

BURY AND DISTRICT JOINT HOSPITAL BOARD.—Assistant to Medical Superintendent. Salary £250 per annum, with board, &c.

CHESTER ROYAL INFIRMARY.—Assistant House Surgeon. Salary £150 per annum, with board, &c.

CLINICAL RESEARCH ASSOCIATION, LIMITED, Watergate House, York Buildings, Adelphi, W.C.—Medical Man or Woman for service in Laboratories.

GREAT NORTHERN CENTRAL HOSPITAL, Holloway-road, N.—Resident Medical Officer. Salary £200 per annum, with board, &c.

HOSPITAL FOR CONSUMPTION AND DISEASES OF THE CHEST, Brompton.—House Physician for six months. Salary 30 guineas.

HUDDERSFIELD, STORTHES HALL ASYLUM, Kirkburton, near Huddersfield.—Locum Tenens. Salary £7 7*s.* per week, with board, &c.

KENT COUNTY COUNCIL.—Tuberculosis Officer. Salary at rate of £500 per annum, &c.

MAIDSTONE, WEST KENT GENERAL HOSPITAL.—Assistant House Surgeon. Salary £125 per annum, with board, &c.

MANCHESTER, ANCOATS HOSPITAL.—House Physician. Salary £200 per annum, with board, &c.

MANCHESTER, BAGULEY SANATORIUM FOR TUBERCULOSIS.—First Assistant Medical Officer, unmarried. Salary £350 per annum, with board, &c.

METROPOLITAN HOSPITAL, TUBERCULOSIS DISPENSARY FOR THE METROPOLITAN BOROUGHS OF HACKNEY AND STOKE NEWINGTON, Kingsland-road, E. 8.—Temporary Medical Officer. Salary at rate of £500 per annum.

NETLEY, WELSH HOSPITAL.—Medical Officer for Pathological Department. Salary £400 per annum, with board, &c.

NEW HOSPITAL FOR WOMEN, Euston-road, N.W.—Female Assistant Physician and Assistant Surgeon.

NEWCASTLE-UPON-TYNE, ROYAL VICTORIA INFIRMARY.—Four House Physicians, Five House Surgeons, Two Accident-room House Surgeons, House Surgeon to Aural and Ophthalmic Department, House Surgeon to Gynæcological Department, House Surgeon to Skin and Venereal Department, House Surgeon to Out-patient Dressing Department.

NORTHAMPTON GENERAL HOSPITAL.—House Surgeon. Salary £200 per annum, with board, &c. Also Two Junior House Surgeons. Salaries £150 per annum, with board, &c.

NOTTINGHAM GENERAL HOSPITAL.—Two Assistant House Surgeons for six months. Salary at rate of £250 per annum each, board, &c.

NOTTINGHAM, NOTTS EDUCATION COMMITTEE.—Female Assistant School Medical Officer. Salary £300 per annum.

PLAISTOW FEVER HOSPITAL, London, E.—Female Temporary Resident Medical Officer, to take Clinical Charge of the Dagenham Sanatorium for Pulmonary Tuberculosis. Salary at rate of £300 per annum, and all found

PRESTON ROYAL INFIRMARY.—Resident Medical and Surgical Officer. Salary £120 per annum, with board, &c.

QUEEN'S HOSPITAL FOR CHILDREN, Hackney-road, Bethnal Green, E.—Two House Physicians for six months. Salary £100 per annum, with board, &c.

ROCHESTER, ST. BARTHOLOMEW'S HOSPITAL, Kent.—Senior Resident House Surgeon. Salary at rate of £300 per annum, with board, &c. Also Clinical Assistant. Salary at rate of £110 per annum, with board, &c.

ROTHERHAM HOSPITAL.—Junior House Surgeon. Salary £150 per annum, with board, &c.

ROYAL FREE HOSPITAL, Gray's Inn-road, W.C.—Senior Resident Medical Officer. Salary £200 per annum. Also House Physician (salary £50 per annum, with board, &c.) and Junior Obstetric Physician (salary £62 per annum, with board, &c.), to include duties at Endsleigh Maternity Hospital. Salary given.

SHEFFIELD ROYAL INFIRMARY.—House Physician. Salary £120 per annum, with board, &c.

SHREWSBURY, SHIRLETT SANATORIUM, Shropshire.—Temporary Assistant Resident Medical Superintendent. Salary £300 per annum.

SOUTH LONDON HOSPITAL FOR WOMEN, 103, South Side, Clapham Common, S.W.—Female House Physician for six months. Salary at rate of £100 per annum, with board, &c.

WEST BROMWICH AND DISTRICT HOSPITAL.—Assistant House Surgeon. Salary £120 per annum, with board, &c.

WEST RIDING OF YORKSHIRE.—Two Temporary School Medical Inspectors. Salary £320 per annum.

WHITEHAVEN AND WEST CUMBERLAND INFIRMARY.—Resident House Surgeon. Salary £150 per annum, with board, &c.

THE Chief Inspector of Factories, Home Office, London, S.W., gives notice of vacancies for Certifying Surgeons under the Factory and Workshop Acts at Annan, at Brampton, and at Tamworth.

Births, Marriages, and Deaths.

BIRTHS.

KELLOCK.—On April 15th, at 2, Upper Wimpole-street, the wife of Thomas H. Kellock, M.C., F.R.C.S., of a son.

MARSHALL.—On April 10th, at Cambridge, the wife of Russell H. S. Marshall, R.A.M.C., of a son.

MCKELLAR.—On April 17th, at Chester-le-Street, County Durham, the wife of Dr. W. A. McKellar, of a son.

WATT.—On April 9th, Dorothy, the wife of James Watt, M.D., Medical Superintendent, Odsal Sanatorium, Bradford, of a son.

WILSON.—On April 12th, at Devonshire-street, W., the wife of Alex. Wilson, M.D., Captain, R.A.M.C., of Crest House, Putney Bridge-road, S.W., of a daughter.

MARRIAGES.

ACKLAND—BUCKLE.—On April 10th, at St. Mary Abbot's, Kensington, William Robert Ackland, Major, R.A.M.C.T., to Georgina, widow of Henry Buckle, Burma Commission (retired).

BELL—CLAYSON.—On March 19th, at St. Andrew's, Farnham, Surrey, William Ker Bell, Captain, R.A.M.C., to Katherine B. Clayson, of Eastleigh, Farnham.

EGAN—MASON.—On April 11th, at St. James's, Piccadilly, W., Staff-Surgeon Percy Blackwood Egan, M.D., R.N., to Rosalie Stella, youngest daughter of the late Mr. O. A. T. Mason, D.I., R.I.C., of Grangefoyle, Strabane, and of Mrs. Mason, Bray, Ireland.

GRAVES—PADDAY.—On April 11th, at St. Barnabas, Kensington, W., George Henry Fullarton Graves, Temporary Lieutenant, R.A.M.C., to Linda Maud, of Holland-road, Kensington, W., eldest daughter of the late Reginald H. Padday, of Singapore.

WILSON—HODGE.—On April 12th, at Hyndland Church, Glasgow, George Hanswell Wilson, M.B., Ch.B., to Amy Lawrence, youngest daughter of Mr. and Mrs. William Hodge, Montgomerie-drive, Glasgow.

DEATHS.

HAWES.—On April 10th, through the sinking of H.M.H.S. *Salta*, Godfrey Charles Browne Hawes, of Pangbourne, Berks, Temporary Captain, R.A.M.C., J.P., M.R.C.S., L.R.C.P., L.S.A.

JONES.—On April 13th, after a short illness, at his residence, 16A, Abercromby-square, Liverpool, aged 53 years, Hugh Richard Jones, M.D.

KING.—On April 11th, at S. Cyprian's, Stratton, Cornwall, John King, M.R.C.S., J.P., in his 73rd year.

LUNN.—On March 5th, at a hospital in India, as the result of an accident, Captain Henry Anderson Lunn, R.A.M.C.

POTTER.—On April 9th, 1917, suddenly, at Brighton, Henry Percy Potter, M.D., F.R.C.S., D.P.H., of Kensington Infirmary, for 37 years Medical Superintendent, aged 63 years.

RUTHERFORD.—On April 11th, at St. Thomas's Hospital, London, Leonard Trevelyan Rutherford, M.A., M.B. Cantab., aged 29.

TAYLOR.—On April 10th, at Windsor, Surgeon-General Sir William Taylor, K.C.B., late Director-General, Army Medical Service, aged 74 years.

THOMPSON.—On April 9th, at Grenville House, Bideford, Charles Sinclair Thompson, M.B.

N.B.—A fee of 5s. is charged for the insertion of Notices of Births, Marriages, and Deaths.

DOCTORS OF MILITARY AGE: THE SQUABBLE AT LETTERKENNY.—An Irish correspondent writes: "An extraordinary scene occurred at a meeting of the Letterkenny Board of Guardians on April 13th. It will be recollected that at a recent election for dispensary doctor there were two candidates, Dr. W. N. Walker and Dr. J. P. McGinley. The latter was elected, but as he was of military age the Local Government Board refused its sanction. The guardians adhere to their decision, and an amusing situation has arisen, Dr. McGinley treating patients at the guardians' dispensary and Dr. Walker at his private surgery, the tickets authorising each doctor to attend patients being signed by the guardians, according to their view as to who is really the legally appointed doctor. At the last meeting of the board, when the pay-sheets of the doctors were submitted for the chairman's signature, the first pay-sheet was snatched from him, and he himself was forcibly ejected from the chair. A wild scene of disorder followed."

Notes, Short Comments, and Answers to Correspondents.

MEDICAL NOTES IN HISTORICAL MANUSCRIPTS: THE STUART PAPERS.

WE give below the concluding excerpts from Part VI. of the Stuart Papers. The first and second instalments appeared in our issues of April 7th (p. 558) and 14th (p. 594) respectively.

Health of James III.—Operation for Fistula.

Pope Clement XI. to James III.—1716, May 19, Santa Maria Maggiore, Rome.—Granting him permission, on account of his health, to eat meat, eggs, &c., on fast days, with an exception as regards meat in Holy Week.

The Duke of Mar to Lieut.-General Dillon.—1716, Oct. 4.—"James has been a good deal out of order for some time with the piles, and though he be now in a fair way of recovery, I hope, yet he is not so easy that he can write."

Queen Mary to the Duke of Mar.—1716, Oct. 10.—"As soon as I had read your letter I sent for Mr. Inese, who you know may be trusted, and consulted with him which way wee should take to gett a good chirurgien to send to Avignon without letting so much as himself know who he went for; wee resolved to employe Dr. Maghie in this affair, since I dare not appear in it myself; he is honest, and is acquainted with several good chirurgiens, and I hope will keep the secret whicch I earnestly recommended to him. I was in hopes all this would have been done this morning, and ther was a chair ready with post horses, but an houre ago Dr. Maghie brought me the enclosed from Mr. Inese and gave me an account of all he has done in this affair, which I made him put in writting, and here I send it you, but I will not seal up this letter till 6 o'clock, by which time Dr. Maghie has promised to lett me know positively whether Guerin will go and what day. If wee cannot prevail with him, wee must take one that he will answer for; nay, he says he cannot go himself without consulting Marechal, of whom he mucch depends, so that wee cannot hinder that, but Dr. Maghie assures me that non of them thinks any mor than that it is a man of quality com out of England that hides himself and will not be known to any, whicch I hope they will still beleeve and suspect nothing els.[1] In all the trouble I am in, which you may much easier imagine than I can express it, it is a comfort to me to have you near the King. ..... I am confident you will be of great use to him in persuading him to be exact in performing the doctors' and chirurgiens' prescriptions and in keeping company and businesse from him."

The enclosure referred to in the above is as follows:—

L. Inese to Queen Mary.—1716, Saturday, Oct. 10, 10 A.M.—"Your Majesty cannot imagine what difficulty there is to find an able surgeon that will go so far on such short warning, they being all engaged with patients they cannot quit on a sudden. I thought it necessary to send Dr. Maghie to inform you of what they say, he having spoke with them, and all of them being of opinion that there can be no danger in some days' delay. The courier that came up has been very indiscreet, having told everybody he was sent by the King to your Majesty. You will be pleased to give your orders to Dr. Maghie who has taken great pains last night and this morning."

Statement by Dr. John Maghie.—"As soon as I received the Queen's orders last night from Mr. Inese I went immediately to Thibaut, the chief surgeon in the Hotel Dieu, one famous in the case. He told me it was impossible for him to make the journey on any account. He recommended Collignon, with whom I was early this morning, and likewise with Monsr. Arnaud, both so engaged that they cannot go. Afterwards I went to Guerin, one as expert as any of the others. He likewise cannot go immediately, but I have hopes to prevail with him in a few days. Observe that Thibaut, Arnaud, and Guerin agree that there can be no danger in delaying the operation for some eight, ten, or twelve days—nay, Arnaud said fifteen, or three weeks. However, no time shall be lost in sending one as soon as possible in whom one can have entire confidence."

L. Inese to Queen Mary.—1716, Sat., Oct. 10, 4 o'clock.—"Dr. Maghie has just come in, and desires your Majesty to be informed that he has been again with Dr. Guerin, who now thinks he can part from this in three days, but he must first speak with M. Marechal on whom he depends. He will give his positive answer to-morrow. As most of such people have an eye to their own interest and it cannot be told them who the person is they are to trust, this M. Guerin made a bargain what he is to have, as he must be absent three weeks or a month and lose his practice, which is considerable, in the meantime. The doctor thinks he should be offered 3000 livres to be secured him when the operation is over, and all his charges going and returning. If you approve, pray let me know and the offer shall be made to-morrow when I see him, or in the manner you think fit, but too great an offer might probably give him suspicion who the person is. He may be told that if all succeeds he shall have a recompense over and above."

L. Inese to the Duke of Mar.—1716, Oct. 13, Paris.—"You will receive this from M. Guerin, who is by all estcemed one of the ablest chirurgeons of Paris and of the greatest experience in the operation he now goes about, and has been always successful in all he has undertaken. He is an élève of the famous M. Marechal and employed by him in the most difficult operations of this kind. I have given him assurance of 3000 livres, besides all his charges and of a reasonable present besides when the operation is happily over. I dared not offer more for fear of giving him suspicion, nor could I offer less, being informed he gains sometimes 3000 livres in a month without going out of Paris. He only knows it is a person of quality he is to treat who will not be named for fear of alarming his relations, but suspects it is either Ormonde or Mar."

Queen Mary to the Duke of Mar.—1716, Oct. 17, Chaillot.—"I dare not send the enclosed to the King for fear the operation should be over before this comes to Avignon; but I dare not omitt sending it to you that you may know what is said and take your measures accordingly. The King and the Duke of Ormond know this fair lady [Olive Trant] very well. She certainly means well, but one must not believe all that is sayd. ..... I pray God direct you and the Duke of Ormonde to do what's best, but if the operation be not made the King should be informed of this and decide himself."

The enclosure referred to in the foregoing is as follows:—

Olive Trant to Queen Mary.—"The surgeon, Marechal's nephew, who is gone to the King, is reputed to be very stupid. Chirac, whom I have just seen, tells me there is one Barancy, a surgeon now living at Montpellier, who is one of the most able in France and it is important that he should attend the King with Guerin, who is not so able as might be wished. There is still time to send Barancy. Your Majesty will have the kindness not to quote Charac as to what I have said about Guerin but he is willing to be [quoted?] about Barancy's ability."

The Duke of Mar to Sir H. Paterson.—1716, Oct. 21.—"When I tell you that James was this morning cut of a fistula *in ano* you will not wonder that I am in a hurry, having letters to write everywhere upon it. I thank God it is well over and he out of danger. He endured the operation with all the fortitude in the world. I was by and was grieved with the King, but charmed with the spirit he showed. The operation lasted about five minutes and was very well performed by Guerin, a chirurgeon we had sent for from Paris. He had ten cuts of the knife and scissors, but the wound is not deep. Both the doctor and chirurgeon assure us that there is no further danger and he is as calm and tranquil as possibly can be expected, without the least appearance of any fever. They will report him dead, I doubt not, who wish it; therefore it would do well that you could have a right account of it put into your newspapers. Since it was God's pleasure he should have this illness, it has not taken him in an unlucky time, for it will give him and his friends time to look about them before they be sent a travelling, if that must needs come. It will be two months before he be in a condition to go anywhere, and sure they will not be so barbarous as to force him to it before he be safe, and before two months expire 'tis hard to tell what may cast up." (Further letters show that James's recovery was slow, but without complications.)

The Duke of Mar to Monsieur Stiernhock.—1718, May 24.—"My master [James III.] had been a little indisposed for a few days before he had the news of the Queen's death, and had some symptoms of an ague, so that account came very unseasonably for that and many other reasons. His indisposition was but slight, occasioned, as far as we can judge, by the sudden change from excessive heat to very cold, which had the same effect on more of us, but I hope a few doses of the bark will carry it off."

James III. to his cousin, the Duchess of Hanover.—1718, Friday, May 27.—"A slight recurrence of tertian fever prevents me from writing to you with my own hand."

James III. to the Prince De Vaudemont.—1718, June 26, Urbino.—"I should have long since sought some consolation from you had I not been for two months prostrated by a fever which has prevented me from the least application."

Lieutenant-General Dillon to the Duke of Mar.—1718, Saturday, June 4.—"I am much troubled to find the King's ague continues. I hope it will soon be over and beseech the Almighty to comfort him in his just affliction. Nairne advised me of the King's taking a vomit 7 May and of his being somewhat weak two days after. No violent remedy can be good for his constitution, and it is not very usual to make an experience on persons of his rank, it being a nice point and not practised except in great extremities. The doctor ought to know best, though it be very sure his prescription will meet with little or no approbation among the physicians here."

COMFORTS FOR THE FORCES.

Mr. John Penoyre, writing on behalf of Sir Edward Ward, Director-General of Voluntary Organisations, says that last year the interval between the last cold night of spring and the first chills of autumn was overestimated, and that this year a vast store of sweaters, mufflers, helmets, mittens, and socks will be wanted by August 1st. These should be sent, when the time draws near, either to the D.G.V.O.'s Depôt, 45, Horseferry-road, S.W. 1, or to Mr. Penoyre, 8, King's Bench Walk, Inner Temple, E.C. 4. Easily knitted patterns of any of the articles mentioned can be had free on application.

ECONOMY IN RUBBER GLOVES.

To the Editor of THE LANCET.

SIR,—Referring to a letter appearing in your issue of March 31st on the above subject, I have examined these repairs, and think that, from the surgeon's point of view, they are satisfactory. From the public point of view, it would appear that the saving to be effected certainly warrants an immediate trial of this method by all hospital authorities, and in particular by the Royal Army Medical Corps controlling the military beds.

I am, Sir, yours faithfully,

Cavendish-square, W., April 9th, 1917. W. ARBUTHNOT LANE.

To the Editor of THE LANCET.

SIR,—In your issue of March 31st last appeared a letter on the repair of surgical rubber gloves by a new process. The amount spent on these gloves is understated; some hospitals must spend £500 or more a year on them. I have used gloves repaired in the manner described for some years at the Leicester Royal Infirmary. The puncture repairs are so small as to be almost unnoticeable. Of course, when rubber has become brittle from repeated sterilisation at a high temperature any repair is useless. A fair proportion of gloves, however, are injured whilst the rubber is still in good

condition, either by puncture with the needle or by manipulation (more particularly in bone operations), or even by pulling them on roughly. Most of these latter are capable of repair. The proportion repairable, however, must vary very considerably, depending on the class of operation, &c. Many hospitals repair their own punctures with rubber solution; even they, however, would be well advised to try the Leicester method for larger tears.

I am, Sir, yours faithfully,
HENRY J. BLAKESLEY, F.R.C.S. Eng.,
Major, R.A.M.C., T.; Senior Honorary Surgeon, Leicester Royal Infirmary.
April 14th, 1917.

THE CHEMICALISING OF CORPSES.

THERE appear to be good reasons for believing that the Germans are utilising the bodies of their dead by committing them to a chemical treatment which, for one thing, yields fat, and, for another, a nitrogenous powder which serves, so it is stated, to enrich pig-feed, and, yet for another, the mineral phosphate of the bones to be used as a fertiliser in the field. The recovery of fat by what may appear to be a gruesome policy means, of course, a source of material for the making of glycerine and its nitro-derivative. The total amount of fat in the human body varies immensely, but it may be said to range from 2·5 to 5 per cent. of the body weight. It is easy to see that in a period of heavy casualties this method for the disposal of the dead will yield a very material amount of glycerine. Thus, a thousand bodies at an average weight of 10 stone (140 lb.) would yield on an average of a 3 per cent. basis of fat per body weight about 2 tons of fat capable of being turned into a tenth of its weight of glycerine—i.e., 4 cwt. As the published number of killed far exceeds this, the output of glycerine may have been increased proportionally, not to mention the soap incidentally produced. The dividends of the enterprising company known as the Kadaververwertungsanstalt (Corpse Utilisation Establishment) may, according to this calculation, be quite satisfactory to the directors and shareholders, enabling them to face criticism with complacency.

PROLONGED NASAL FEEDING.

To the Editor of THE LANCET.

SIR,—A man was admitted to this asylum in 1885 and has just died here at the age of 81. For several years he had to be spoon-fed after his admission, but for the last 21 years and 7 months he was fed three times daily through the nasal tube. He enjoyed excellent health until the last three months, when his health began to fail. I never heard of his taking a drink of water for all these years, but during the last two days of his life he took warm milk from a fellow-patient, but not from an attendant. The following was his daily diet scale:—

Breakfast: One quart of milk, two eggs, and 1½ oz. of sugar. Dinner: One quart of beef tea, or beef fluid made from bovril or oxo, and one or two potatoes, mashed fine enough to go through the nasal tube. Supper: One quart of milk, one egg, and 1½ oz. of sugar.

Is this a record in prolonged nasal feeding?

I am, Sir, yours faithfully,
E. E. MOORE, M.D. Dub.,
Medical Superintendent.
Donegal District Asylum, Letterkenny, April 13th, 1917.

HEALTH OF ST. LUCIA.

A REPORT on the colony of St. Lucia for the year 1915–16 has just been presented to Parliament. From this it appears that the population is estimated to consist of 24,115 males and 28,167 females—total 52,282—a slight increase as compared with the previous year. The birth-rate for 1915–16 was 33 per 1000 of the population and the death-rate 19·7 per 1000. There were two deaths from snake-bite and one from scorpion-bite. All the medical officers report the health conditions of the year to have been favourable. The hookworm campaign, inaugurated at the expense of the International Health Commission, continued its work under the direction of Dr. Stanley Branch, a local district medical officer seconded for this purpose; and side by side with this campaign the Government is adopting measures for the improvement of the sanitary conditions in the colony generally. The Victoria Hospital at Castries is the one general hospital for the colony, and the daily average number of patients was 70. The construction of a wing for private paying patients has been commenced. Small buildings are provided in the out-districts at Soufrière, Dennery, and Vieux Fort which are used as casualty hospitals for accident and emergency cases, and there are visiting stations at various points where medical officers attend regularly on fixed days for the treatment of out-door cases of sickness.

The yaws hospital, which is in the vicinity of the Poor Asylum at Malgretoute, had a daily average of 43·2 patients. The voluntary influx of patients for treatment with arsenobenzol continued unabated during the year, and 443 cases were treated. The medical officer in charge, Dr. A. F. Hughes, reports that up to date he had treated 1188 cases, and that out of this number there had been 63 cases of recurrence of the disease. In this latter connexion the medical officer refers to the difficulty of his distinguishing between bona-fide recurrences and cases of reinfection.

SPRUE.

REFERRING to the annotation which appeared under the above heading in our issue of last week, Mr. John Ward, of the Crookes Laboratories, states that the use of collosol argentum in this disease was mentioned in papers read before the annual meetings of the British Medical Association in 1913 and 1914, notably by Mr. James Cantlie. Further experience, he adds, indicates the alternate use of collosol argentum and collosol iodine—of course, by internal administration.

Recruits.—The fees should, in our opinion, be included in our correspondent's return for income-tax, as the profit arising therefrom can scarcely be defined as profit arising from a single or casual transaction outside the usual scope of the profession. The point might be put before the district surveyor of taxes, whose advice is usually sound and impartial.

Medical Diary for the ensuing Week.

SOCIETIES.

ROYAL SOCIETY OF MEDICINE, 1, Wimpole-street, W.
MEETING OF SECTION.
Friday, April 27th.

STUDY OF DISEASE IN CHILDREN (Hon. Secretaries—A. S. Blundell Bankart, E. A. Cockayne, C. P. Lapage): at 4.30 P.M.
Cases:
Dr. F. Parkes Weber: (1) Lipodystrophia Progressiva in a Male; (2) Congenital Letter-blindness—Congenital Alexia and Agraphia without Aphasia; (3) Bilateral Optic Nerve Atrophy in a Child with Positive Wassermann Reaction and History of Infantile Convulsions.
Specimen:
Dr. E. A. Cockayne: A Case of Congenital Defect of the Duodenum in which Bile was Found both Above and Below the Absent Portion.
Paper:
Dr. H. C. Cameron: Status Lymphaticus from the Clinical Standpoint.

LECTURES, ADDRESSES, DEMONSTRATIONS, &c.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, Lincoln's Inn Fields, W.C.
Museum Demonstrations (Pathology) for Medical Students and Practitioners and First-Aid and Ambulance Students:—
MONDAY —5 P.M., Mr. S. G. Shattock: Gunshot Injuries.

POST-GRADUATE COLLEGE, West London Hospital, Hammersmith-road, W.
MONDAY.—2 P.M., Medical and Surgical Clinics. X Rays. Mr. Gray: Operations. Mr. B. Harman: Diseases of the Eye. Dr. Simson: Diseases of Women.
TUESDAY.—2 P.M., Medical and Surgical Clinics. X Rays. Mr. Baldwin: Operations. Dr. Banks Davis: Diseases of the Throat, Nose, and Ear. Dr. Pernet: Diseases of the Skin.
WEDNESDAY.—10 A.M., Dr. Saunders: Diseases of Children. Dr. Banks Davis: Operations of the Throat, Nose, and Ear. 2 P.M., Medical and Surgical Clinics. X Rays. Mr. Pardoe: Operations.
THURSDAY.—2 P.M., Medical and Surgical Clinics. X Rays. Mr. Gray: Operations. Mr. B. Harman: Diseases of the Eye.
FRIDAY.—10 A.M., Dr. Simson: Gynæcological Operations. 2 P.M., Medical and Surgical Clinics. X Rays. Mr. Baldwin: Operations. Dr. Banks Davis: Diseases of the Throat, Nose, and Ear. Dr. Pernet: Diseases of the Skin.
SATURDAY.—10 A.M., Dr. Saunders: Diseases of Children. Dr. Banks Davis: Operations of the Throat, Nose, and Ear. Mr. B. Harman: Eye Operations. 2 P.M., Medical and Surgical Clinics. X Rays. Mr. Pardoe: Operations.

ROYAL INSTITUTE OF PUBLIC HEALTH, Lecture Hall of the Institute, 37, Russell-square, W.C. 1.
Course of Lectures and Discussions on Public Health Problems under War and After-war Conditions:—
WEDNESDAY.—4 P.M., Lecture II.:—Dr. C. Porter: Citizenship and Health Questions in War Time. Followed by a discussion.

ROYAL INSTITUTION OF GREAT BRITAIN, Albemarle-street, Piccadilly, W
FRIDAY.—5.30 P.M., Dr. J. D. Grant: The Organs of Hearing in Relation to War.

METEOROLOGICAL READINGS.

(*Taken daily at 8.30 a.m. by Steward's Instruments.*)
THE LANCET Office, April 18th, 1917.

Date.	Rain-fall.	Solar Radio in Vacuo.	Maximum Temp. Shade.	Min. Tem.	Wet Bulb.	Dry Bulb.	Remarks.
April 12	...	75	46	34	36	38	Cloudy
,, 13	0·01	89	51	33	36	38	Fine
,, 14	...	68	50	38	43	45	Cloudy
,, 15	...	94	51	38	36	39	Fine
,, 16	0·15	77	47	35	39	42	Fine
,, 17	0·12	79	47	38	37	40	Cloudy
,, 18	0·09	70	52	38	45	45	Raining

Other information which we have been accustomed to give in these "Readings" is withheld for the period of the war.

EDITORIAL NOTICES.

IT is most important that communications relating to the Editorial business of THE LANCET should be addressed *exclusively* "TO THE EDITOR," and not in any case to any gentleman who may be supposed to be connected with the Editorial staff. It is urgently necessary that attention should be given to this notice.

It is especially requested that early intelligence of local events having a medical interest, or which it is desirable to bring under the notice of the profession, may be sent direct to this office.

Lectures, original articles, and reports should be written on one side of the paper only, *and when accompanied by blocks it is requested that the name of the author, and if possible of the article, should be written on the blocks to facilitate identification.*

Letters, whether intended for insertion or for private information, must be authenticated by the names and addresses of their writers—not necessarily for publication.

We cannot undertake to return MSS. not used.

Offices: 423, STRAND, LONDON, W.C. 2.

MANAGER'S NOTICES.

ALTERATION IN THE PRICE OF "THE LANCET."

INCREASED war expenses and cost of production necessitate an increase of the price of THE LANCET. Commencing with the new year, the price was raised to 8*d*. The rates of subscription remain as revised in October.

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